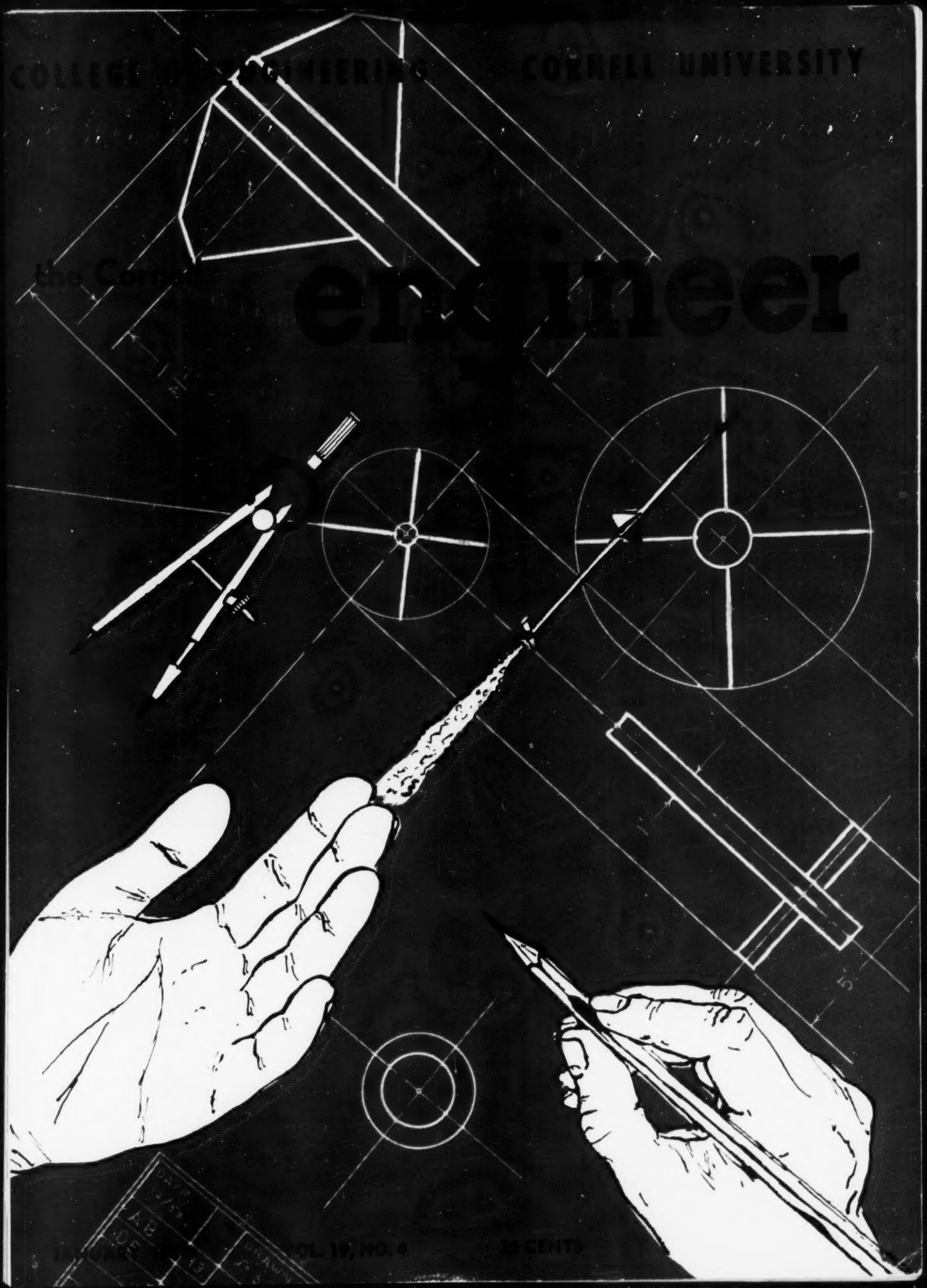
COLLEGE OF ENGINEERING · CORNELL UNIVERSITY

the Cornell engineer

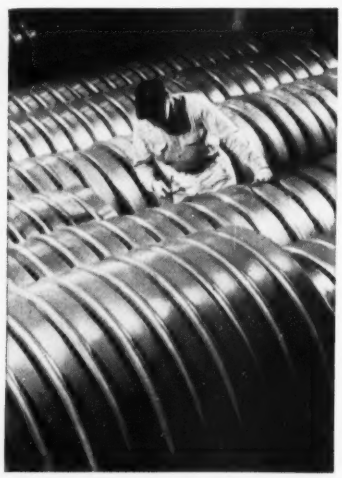


JANUARY 1964 · VOL. 19, NO. 4 · 25 CENTS

Only STEEL can do so many jobs so well

World's Largest Double Swing-Span Bridge. The George P. Coleman Memorial Bridge spans the deep swift York River between historic Yorktown and Gloucester Point, Va. Two 500-foot swing spans, each weighing 1,300 tons, pivot horizontally on piers 44 feet in diameter, swinging open simultaneously to provide a 450-foot freeway that can accommodate the passage of even the largest vessel. This 3,750-foot-long bridge was fabricated and erected by U. S. Steel.

Landing at Sea. When a fighter pilot lands his plane on a flattop, one of his biggest problems is *stopping* the plane. To help him, a hook attached near the plane's tail engages one of the galvanized wire cables, mounted on spring brackets, that stretch across the deck. The resiliency of the cable, plus the bracket action, helps the plane to stop promptly and safely.



Ready to Roll. Trains move faster today, they carry heavier loads, they cover longer distances. This puts a premium on durability and safety in the *wheels* they roll on. U. S. Steel has been making wrought steel wheels for 47 years, has helped to bring the art of wheelmaking to its present high level.

OPPORTUNITIES WITH U. S. STEEL

If you're thinking about what you're going to do after graduation . . . . if you're interested in a challenging, rewarding position with a progressive company . . then it will pay you to look into the opportunities with United States Steel. Your placement director can give you more details, or we'll be glad to send you the informative booklet, "Paths of Opportunity." United States Steel Corporation, 525 William Penn Place, Pittsburgh 30, Pa.

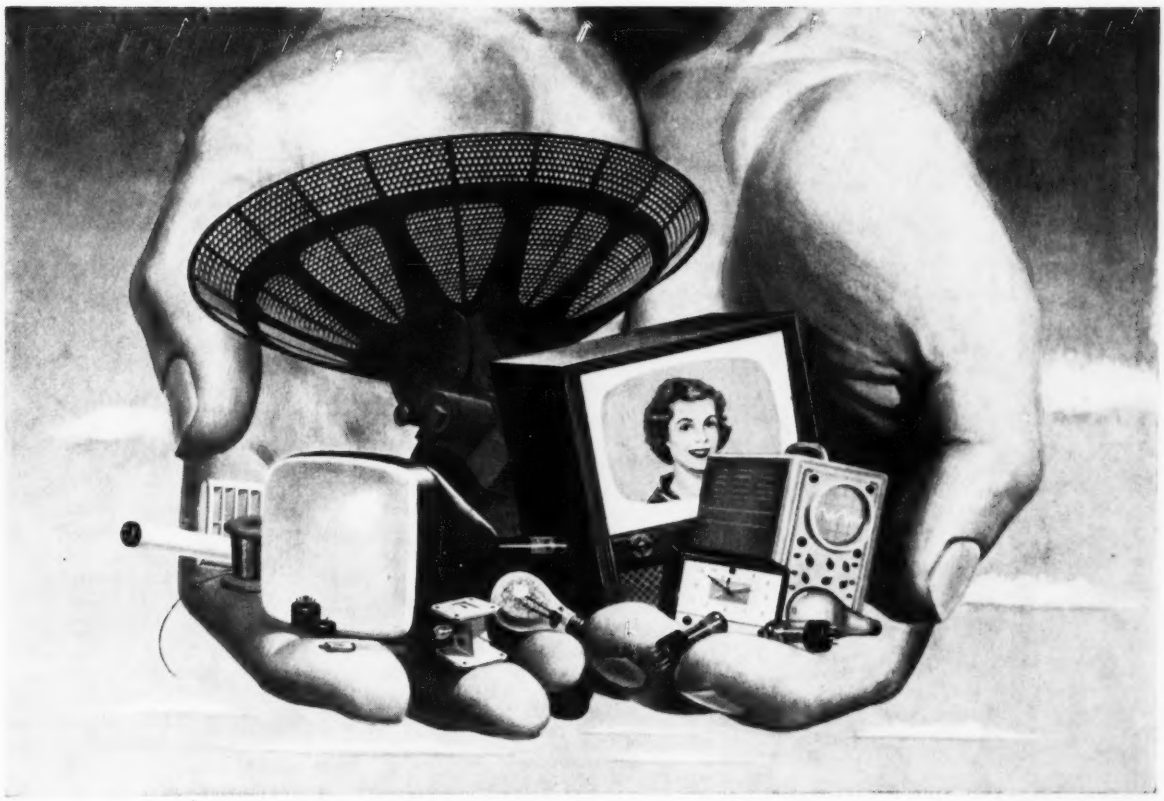
MANUFACTURED FROM USS STEEL UNITED STATES STEEL

UNITED STATES STEEL

This trade-mark is your guide to quality steel

For further information on any product mentioned in this advertisement, write United States Steel, 525 William Penn Place, Pittsburgh 30, Pa.

AMERICAN BRIDGE · AMERICAN STEEL & WIRE and CYCLONE FENCE · COLUMBIA-GENEVA STEEL · CONSOLIDATED WESTERN STEEL · GERRARD STEEL STRAPPING · NATIONAL TUBE
OIL WELL SUPPLY · TENNESSEE COAL & IRON · UNITED STATES STEEL PRODUCTS · UNITED STATES STEEL SUPPLY · *Divisions of* UNITED STATES STEEL CORPORATION, PITTSBURGH
UNITED STATES STEEL HOMES, INC. · UNION SUPPLY COMPANY · UNITED STATES STEEL EXPORT COMPANY · UNIVERSAL ATLAS CEMENT COMPANY 4-89



THIS IS SYLVANIA...

BIG ...*diversified*... GROWING

THE IDEAL ENVIRONMENT FOR YOUNG ENGINEERS

In 1953, Sylvania's 40 plants in eleven states produced upwards of $300 million worth of products in more than sixty categories of lighting, radio, television and electronics equipment.

This year will see the completion of additional new plants and laboratories, as another phase of a continuing expansion program which has doubled plant and equipment in the past few years.

As a graduate engineer, you'll naturally find a wide range of opportunities in every phase of engineering at Sylvania. And you'll find yourself making rapid headway as the company continues to add new facilities, new fields.

A stimulating atmosphere of accomplishment and opportunity — plus size, growth, and diversity — make Sylvania, a company of young men where the executive level averages 45 years of age, an ideal place to build a satisfying career in engineering.

For detailed information, see your College Placement Office or send for our comprehensive brochure, "Today and Tomorrow with Sylvania", by writing to Supervisor of Technical Employment.

Opportunities, too, at Sylvania's 16 research and development laboratories.

SYLVANIA

Sylvania Electric Products Inc.

1740 Broadway, New York 19, N. Y.

LIGHTING • RADIO • ELECTRONICS • TELEVISION

MORE THAN 100 TIMES FASTER THAN THE HUMAN BRAIN

The special character of the application of an electronic digital computer for airborne automatic controls is reflected principally in the input-output units.

The physical quantities defining the state of the system—such as altitude, rate of climb, heading, and other vital information—are measured by instruments whose outputs are usually in the form of mechanical displacements or voltages. These analog quantities are converted into digital numbers that are processed by the computer; it performs in "real" time the computations corresponding to the mathematical representation of the control problem. The results of these calculations are numbers representing the signals used to control the system. These output numbers are converted into the analog-type signals used in the control operations.

At Hughes Research and Development Laboratories, where the subminiature airborne digital computer was pioneered, analog-digital input-output systems have been developed for several applications.

For example, in the conversion of direct-current voltages to binary numbers, the many input voltages are digitalized in sequence by a comparison with a precisely linear saw-tooth waveform, gated once per revolution of the drum to successive inputs. Time intervals are produced which are used to control a gated binary counter. Resulting binary numbers are stored in the memory for subsequent use by the computer. Output binary numbers each control the symmetry of a square wave recorded on a drum channel during the output sampling periods. Reading heads continuously present the waveforms to the respective output channels where they are standardized by regulated-current switch tubes and are filtered to establish the direct-current components. Several such waveforms may be time-shared on a single drum channel by encoding.

A major effort at Hughes is also devoted to adapting electronic digital computer techniques to business data processing and related applications—uses destined for far-reaching peacetime application.

ENGINEERS AND PHYSICISTS

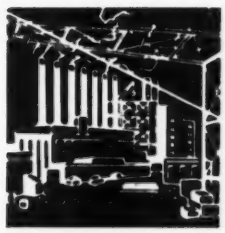
Activities at Hughes in the computer field are creating positions in the Laboratories. Experience in the design and application of electronic digital computers is desirable, but not essential. Engineers and physicists with backgrounds of component development or system engineering are invited to apply.

Address:
SCIENTIFIC
AND
ENGINEERING
STAFF

HUGHES
RESEARCH
AND DEVELOPMENT
LABORATORIES
Culver City, Los Angeles County
California

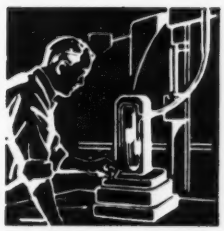
Input-output units (above) of the Hughes airborne electronic digital computer. (Left) Operation of the pilot's direction indicator is discussed by W. S. Shockency (left), Radar Laboratory, and M. L. MacKnight of the Advanced Electronics Laboratory.

5 paths to your success at DETROIT EDISON



• Engineering Planning, Design and Construction

The development and economic utilization of progressive engineering methods to make possible the continued expansion of industry and modern electrical living.



• Power System Engineering

The application of proved engineering principles to the problems of operating the equipment used in the production, transmission and distribution of electric power.

• Sales and Customers Service

The promotion of increased sales by helping the consumer make the best use of the energy he buys, and by showing him how to let electricity do more of his jobs.

• Research

The investigation of problems which daily face any part of the production, distribution or sale of electricity, and making recommendations for their solution.

• Business Management

The coordination of problems related to Company finance, materials, property and personnel for the efficient operation of the electric business.

These are the five principal channels through which graduates may advance at The Detroit Edison Company. Under these broad headings are hundreds of different positions—all working together for the best interests of customer, employe, and investor.

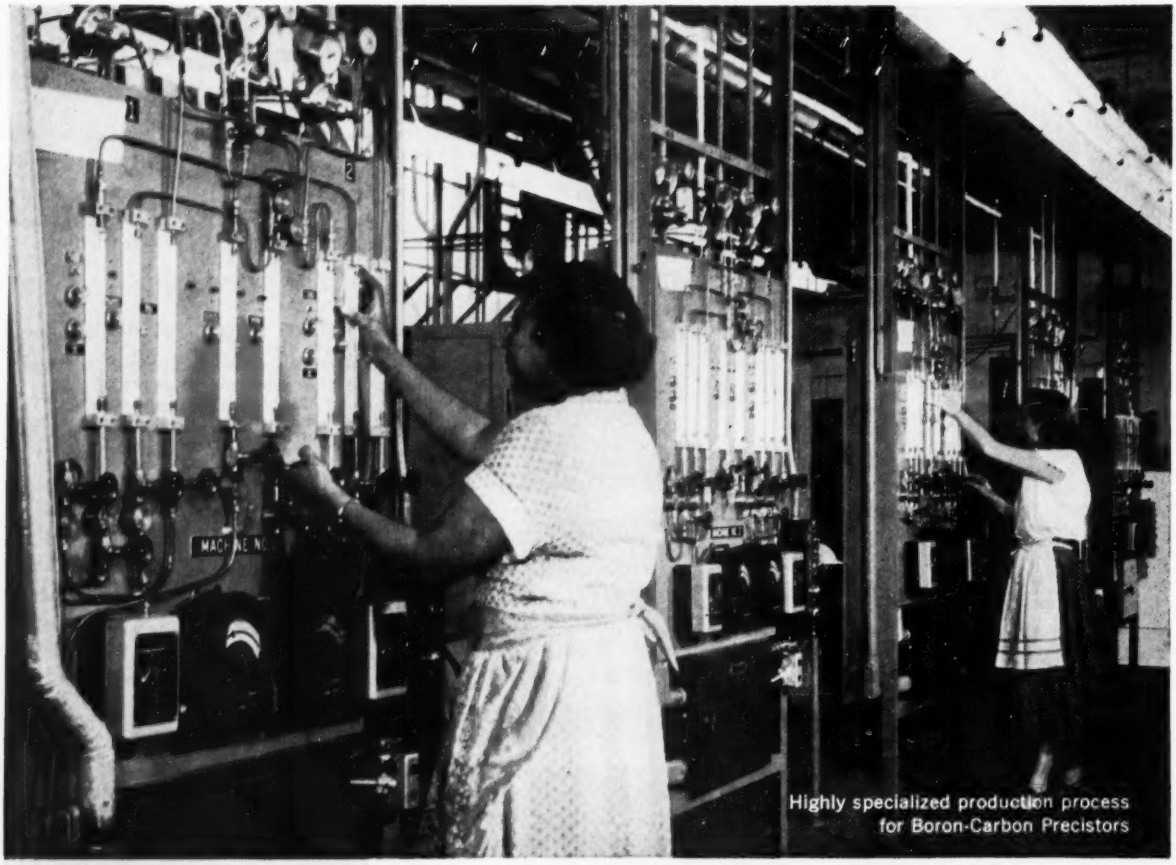
When a graduate joins The Detroit Edison Company, he is assured every opportunity to fit into the job he likes best—and, once there, he knows he will be encouraged to advance as rapidly as his ability and energy will carry him.

Detroit Edison is a fast-growing electric utility company. It is foresighted, too. For example, Detroit Edison engineers are working with Dow Chemical Company as one of the nation's industrial atomic research teams investigating the use of nuclear heat in thermal electric generating plants, to produce electric power even more efficiently.

There's a future for graduates at The Detroit Edison Company—a career opportunity best described by the fact that many of the executives in the organization at this time began their climb to success in positions similar to those offered graduates today.

The DETROIT EDISON Company

2000 SECOND AVENUE
DETROIT 26, MICHIGAN



Highly specialized production process
for Boron-Carbon Precistors

BASIC TECHNIQUE

A thin coating of pre-cured and stabilized resistance material is bonded to special glass or an inorganic core to form IRC's exclusive filament type element. This is in contrast to the carbon pill or slug principle of construction. Its uniformity and stability have proved superior since the earliest days of radio.

SPECIFIC EXAMPLES

IRC Type BOC Boron-Carbon Precistors

IRC Filament Type BT Resistors

IRC Type DC Deposited Carbon Resistors

IRC Type MV High Voltage Resistors

ONLY FILM TYPE RESISTORS MEET HIGHER STABILITY STANDARDS

. . . another reason why engineers prefer IRC Resistors

Advancing requirements of instrumentation, military electronics and television focus emphasis on greater stability for non-wire wound resistors. IRC believes its filament type construction offers the best answer to more exacting standards. For over 28 years the film type resistance element has proved its superior stability—even in today's newest IRC Boron-Carbon Precistor.

IRC

Wherever the Circuit Says

INTERNATIONAL RESISTANCE CO.

401 N. Broad St., Phila. 8, Pa.

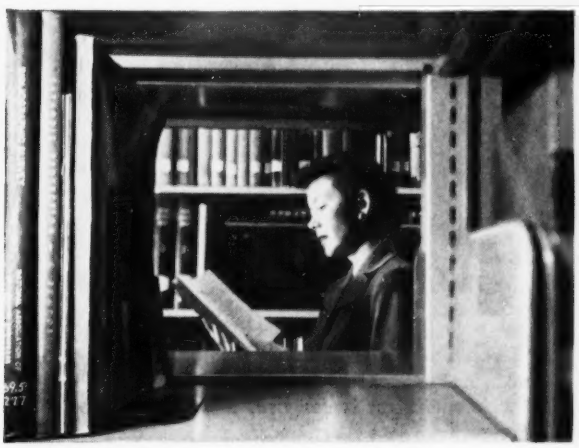
In Canada: International Resistance Co., Toronto, Licensee

DOW

NEW DOW

Technical Library

ENABLES EMPLOYEES TO FURTHER STUDIES



These modern facilities provide an extremely wide range of scientific material including current information on all fields of research

The desire to provide complete technical knowledge for Dow personnel, together with intelligent planning, has produced at Midland, Michigan, one of the most comprehensive of all industrial libraries. This modern, air-conditioned structure contains over 35,000 books and over 600 magazines. New books are added regularly, and both foreign and domestic abstracts are made available.

Most of the material is highly technical. The most extensive coverage is given to material in the fields of chemistry, electrochemistry, biochemistry, agricultural chemistry, chemical engineering, physics and nuclear physics.

In addition to published material, the library also furnishes an index of all research work conducted by all divisions of The Dow Chemical Company.

This new library is but one example of Dow's efforts to offer the finest facilities for work and recreation to its employees. THE DOW CHEMICAL COMPANY, Midland, Michigan.

Dow's Booklet "Opportunities With The Dow Chemical Company", especially written for those about to enter the chemical profession, is available free, upon request. Write to The Dow Chemical Company, Technical Employment, Midland, Michigan.

you can depend on DOW CHEMICALS

DOW

"I chose Worthington for opportunities in international trade"

• "Worthington was my choice," Mr. Berger says, "because of the excellent training and the unusual experiences that are possible with a manufacturer having a worldwide reputation, and worldwide distribution. Then, when a company has seventeen divisions, including air conditioning, refrigeration, turbines, Diesel engines, compressors and pumps of all kinds, construction machinery, and power transmission equipment, a graduate engineer's chances for getting into his chosen field are even better.

"Supporting these divisions are research, engineering, production, purchasing, and sales, domestic and export. The real opportunity, however, is in Worthington itself. This is a company that is growing, just as it has for more than a century. It is always looking for new, related products and good men to engineer, produce, and sell them—at home and abroad.

"I began my career with Worthington's training program in the Research and Development Laboratory, where full-scale equipment is designed, tested and improved. This experience gave me an understanding of the tremendous part the company plays in the everyday life of millions of people. Within fourteen months I was sent to Mexico to inspect the facilities of our distributors there.

"The opportunities for first-hand laboratory experience, sales training and contact, travel and field trips, among many others, make Worthington a first-rate company for the young engineer with a desire to learn and progress in his work."

When you're thinking of a good job, think *high*—think *Worthington.*

8.26

FOR ADDITIONAL INFORMATION, see your College Placement Bureau, or write to the Personnel and Training Department, Worthington Corporation, Harrison, N. J.

WORTHINGTON

THE SIGN OF VALUE AROUND THE WORLD

Janice Button EP '54
editor-in-chief

M. Douglas McIlroy EP '54
managing editor

George Edwards EE '55
business manager

◇

Publication Board

Edwin A. Leventhal EP '56
assistant editor

John F. Schmutz ChemE '55
associate editor

Alan F. Cohen CE '55
illustrations editor

Milton Cherkasky ME '55
treasurer

Robert S. Arlook ChemE '54
circulation manager

Francis B. DeGress ME '57
advertising manager

William C. Thurber MetE '55
publicity manager

Robert Posner ME '55
office manager

Editorial Board

R. P. Allen ME '56
A. J. Burns EE '56
D. G. Douglas CE '56
R. C. Eckert ME '56
R. H. Kantor EP '57
J. Max ChemE '57
L. C. Olson ChemE '57
T. C. Reed ME '56
F. J. Rosengarten ChemE '57

◇

Business Board

J. L. Beckel Arch '56
Y. Brazel EE '56
R. K. Fisher ChemE '57
G. Haunalter CE '57
I. M. Jacobs EE '56
L. Pisnoy CE '57

◇

Illustrations Board

D. Ball CE '55
S. G. W. Beck EE '56
D. Crook Arch '56
E. Matzal ChemE '56
R. C. Noyes ME '55
R. L. Simon EE '54
E. M. Zelin EE '57

◇

Advisory Board

Dean S. C. Hollister

Technical Advisors

Prof. W. H. Erickson
Prof. J. E. Hedrick

School Directors

Prof. C. R. Burrows EE
Prof. N. A. Christensen CE
Prof. F. H. Rhodes ChemE
Prof. L. P. Smith EP
Prof. H. J. Loberg ME

Alumni

H. H. Williams, Jr. C.E.'26
W. H. Hill M.E.'22

Founded 1885

THE CORNELL engineer

JANUARY, 1954 VOLUME 19 NUMBER 4

THE DEVELOPMENT OF CORNELL'S ENGINEERING COLLEGE 9
by S. C. Hollister, Dean

WHAT'S IN STORE FOR THE CORNELL ENGINEERING GRADUATE? 11
by John F. McManus, C.E. '36, Assistant to the Dean

CIVIL ENGINEERING 12
by N. A. Christensen, Director,

MECHANICAL ENGINEERING 14
by Harry J. Loberg, Director

ELECTRICAL ENGINEERING 16
by C. R. Burrows, Director

CHEMICAL AND METALLURICAL ENGNIEERING 18
by F. H. Rhodes, Director

ENGINEERING PHYSICS 20
by L. P. Smith, Director

THE COLLEGE OF ARCHITECTURE 22
by T. W. Mackesey, Dean

SOME OBSERVATIONS CONCERNING THE COLLEGITRON 24
by Thomas Reed, ME '56

BRAIN TEASERS 26

EXTRACURRICULAR ACTIVITIES 30
by Lavonne Olson, Chem.E. '57

COLLEGE NEWS 44

CORNELL UNITED RELIGIOUS WORK 45

OUT OF PHASE 49
by Herbert Spirer, E.P. '51

PRESIDENT'S PAGE 53

ALUMNI ENGINEERS 55

STRESS AND STRAIN 60

COVER —*Don Schudel*

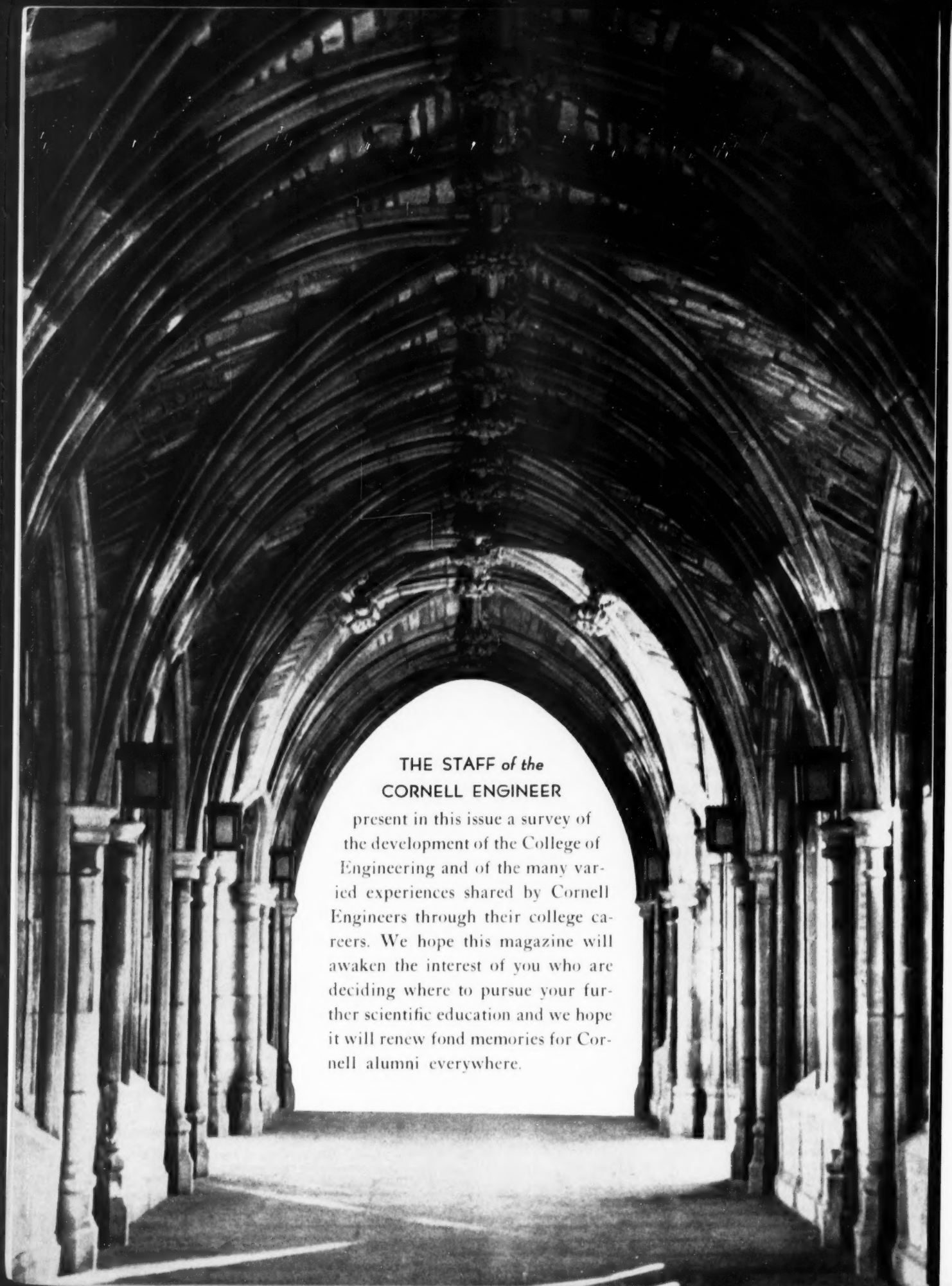
FRONTIS—War Memorial Cloisters at Cornell —*Alan F. Cohen*

Member of The Engineering College Magazines Associated

Chairman: Prof. Thos. Farrell, State University of Iowa, Iowa City, Iowa
Publishers' Representative, Littell-Murray-Barnhill, Inc.
101 Park Ave., New York and 605 N. Michigan Ave., Chicago

Published monthly—October to May—by the CORNELL ENGINEER, Inc., Lincoln Hall, Ithaca, N. Y. Edited by the undergraduates of the College of Engineering, Cornell University. Entered as second class matter at the Post Office at Ithaca, N. Y., under Section 103, Act of October 3, 1917.

Subscription per year: regular $2.00; with membership in the Cornell Society of Engineers $3.00 (See President's page); student $1.50; single copy $.25.



THE STAFF *of the*
CORNELL ENGINEER

present in this issue a survey of the development of the College of Engineering and of the many varied experiences shared by Cornell Engineers through their college careers. We hope this magazine will awaken the interest of you who are deciding where to pursue your further scientific education and we hope it will renew fond memories for Cornell alumni everywhere.

The Development of Cornell's Engineering College

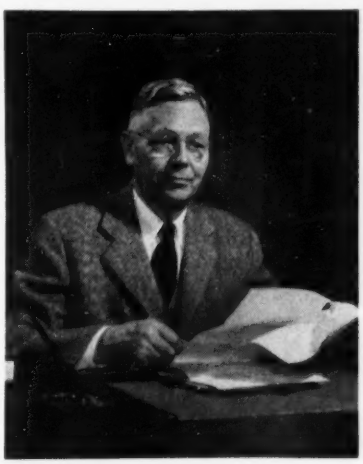
by S. C. HOLLISTER, Dean
College of Engineering

Founded by the builder of the first telegraph line, Cornell has always pioneered in applied science

Another important milestone has been achieved by the College. Construction has begun upon Phillips Hall, the new home of the School of Electrical Engineering. It is to be completed by December 31, 1954; a year from now, therefore, it should be in operation.

This event brings to mind once more the place Cornell has occupied in the field of electrical engineering. Ezra Cornell, the founder, built the first telegraph line in the world between Washington and Baltimore, over which Samuel Morse sent the famous first message in 1844. Mr. Cornell went on to build commercial lines, setting up small companies as he did so. In 1856, with Mr. Hiram Sibley of Rochester, New York, he formed the Western Union Telegraph Company. Mr. Cornell became well-to-do as the result of his activities in this earliest branch of the electrical industry. In 1865, he founded Cornell University, giving it the initial endowment. In 1870, Mr. Sibley donated the first engineering building.

Electrical engineering instruction began at Cornell in 1875 when there was built on this campus the first ring-wound dynamo constructed in the western hemisphere, along the lines of, but with some improvements over, the original machine constructed in France the year before. A separate curriculum leading to the Bachelor's Degree in Electrical Engineering was set up at Cornell in 1883, and the first graduation from that program was in 1885. Prior to this time there had been no graduates in electrical engineering anywhere in America. Graduate instruction in electrical engineering had also begun at Cornell during this period, and the first doc-



Dean Hollister

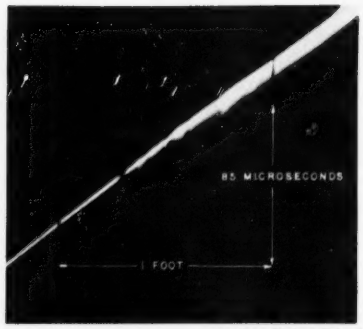
torate in the field was awarded in 1885 at Cornell. Four years later the first department of electrical engineering was established here.

At this time there began the discussion of the best method of transmitting electrical energy. Direct current had been used, but had been found to have definite limitations. Alternating current, therefore, was gradually resorted to, but this necessitated developing means of transformation to high voltages for transmission purposes. Professor Harris J. Ryan, head of electrical engineering at Cornell, undertook investigation early in the 1890's and constructed the first high-voltage transformer, which he used for experimental purposes to develop the principles on which transformers should be designed. He became famous as the leader in high voltage transmission experimentation. Continuing this tradition, Cornell's new High Voltage Laboratory, being constructed to replace the one lost by fire in 1948, is nearing completion. During the year we expect delivery of the large transformers which will make possible single-phase 60-cycle current in excess of one million volts. Preparation for the construction of a three million volt surge generator has also begun.

The School of Electrical Engineering has acquired a network-analyzer, which will be installed in the new building. This equipment, valued at nearly $400,000, will make possible the analysis of simulated transmission networks necessary in the design and operation of extensive inter-connected grids.

The School of Electrical Engineering has been a leader in the fields of Radio Astronomy and of high-frequency long-distance communication. Many problems impor-

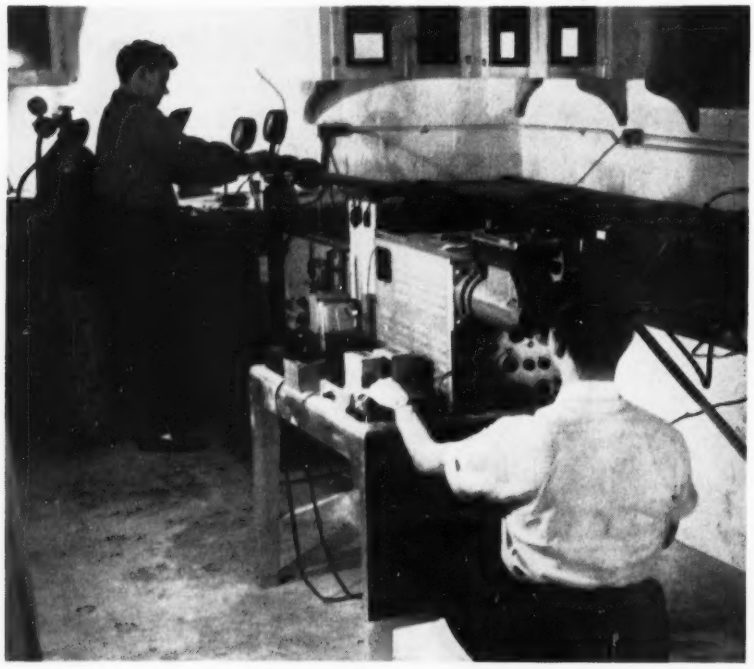
In the apparatus shown below are produced shock waves of extremely high strength to provide for study of phenomena occurring in violent shock fronts. The fronts are produced by exploding a gas contained behind a diaphragm at one end of the evacuated tube. The diaphragm is burst by the explosion and the front travels rapidly down the tube past an observation window. Temperatures in excess of 15,000°C. exist in the narrow front, making it intensely luminous. Moving strip photographs, like that at the right show a narrow band of luminescence traveling toward the right, followed by a dark gap after which comes another luminous band of heated gas. Horizontal slices of the picture correspond to longtitudinal cross sections of the tube at a given instant of time. Astronomers have observed similar phenomena in solar explosions like that pictured below.



—*Cornell Aero School*

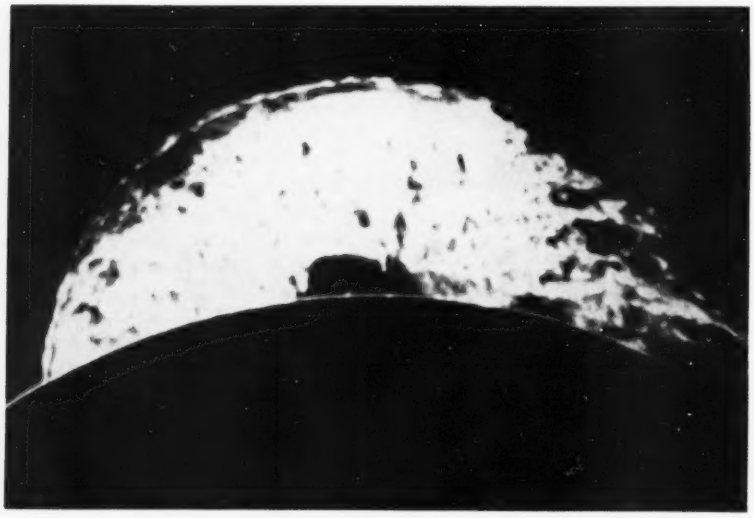
The supersonic shock tube at the School of Aeronautical Engineering.

—*Cornell Aero School*



A solar explosion, a large-scale counterpart of experiments in the shock tube above. Note the luminous leading edge followed by a narrow dark band.

—*Harvard Observatory*



tant to the electrical engineer derive from phenomena in the fields of physics of the upper atmosphere and of astrophysics.

Mr. E. L. Phillips, for whom the new building is named and through whose foundation it was made possible, was graduated from Cornell in Electrical Engineering 1895. He spent his professional life in the development of the electrical utilities. In his life-time electrical engineering has advanced from the building of the first dynamo in the western world to the study of important electrical phenonoma arising in interstellar space. During this time the entire development of electrical engineering as a special branch of study has been brought into being. Cornell, as a leader in this entire development in electrical experimentation and education, is proud of the achievements of its graduates and the contributions they have made in this important branch of engineering that has contributed so extensively to the benefit of mankind.

Phillips Hall is not alone a monument in the development of the School of Electrical Engineering. It becomes the third of the five-building group forming the basic plan of the new engineering quadrangle at the south end of the campus. Olin Hall, which houses the School of Chemical and Metallurgical Engineering, the gift of Franklin W. Olin of the Class of 1886, founder of Olin Industries, was completed in 1942. The intervention of the war delayed the building program. It was not until a year ago that the second building was completed. This consisted of two units, Kimball Hall and Thurston Hall, the first housing the laboratories

(*Continued on page* 17)

What Is in Store for the Cornell Engineering Graduate?

by JOHN F. McMANUS, C.E. '36
Assistant to the Dean

Dean Kimball frequently told the story of a correspondence with a renewed industrial leader who once wrote to him, more or less in these words: "I should like to have my son study engineering at Cornell largely because of the high regard we have for the men who have come to our organization from your school. I am puzzled however as to the branch of engineering he should study, since it seems that some of our major advances in the chemical field have been made by Cornell mechanical engineers and mechanical problems as often as not are tackled by your electrical engineers, and so on. How do you advise a boy as to which engineering he might best study, under the circumstances?" To this Dean Kimball replied: "It doesn't make any difference what branch of engineering he studies. If he becomes a Cornell engineer, he can do anything!"

It would be interesting and colorful to set down the achievements and personalities of the long line of eminent Cornell Engineers and particularly to develop thereby the intangible but nevertheless inevitable characteristic that seems to mark a man as a "Cornell Engineer." This is beyond the scope of this article, so we must be content here with a few generalities and perhaps a few statistics that smumarize the evidence.

One study bearing on this subject is a monumental work originally undertaken in 1932 by Dr. Donald B. Prentice, at that time president of Rose Polytechnic Institute, in which he has tabulated the collegiate backgrounds of the full listing of engineers in the 1931, 1937, and 1948 editions of *"Who's Who in Engineering.* In terms of total numbers of graduates listed, M.I.T., Cornell, Michigan, Illinois, and Purdue consistently led each of the three studies in that order. Although over 300 institutions (not all engineering colleges) had one or more graduates listed, the heavy concentration was among the top ten, with more than 12 per cent coming from M.I.T. and Cornell.

Since differences in size and age of institutions tend to influence the total numbers of graduates distinguished by a special listing of this kind, the proportion of alumni so listed in terms of total potential is especially interesting. On this basis, Cornell consistently had the *highest percentage* of engineering graduates in the *"Who's Who"* listings studied of any institution in the country. This attests to a major characteristic of Cornell Engineers that appears constantly over the years—the quality of leadership.

In measuring the performance of our alumni we must necessarily look to the past. However it is important to know also that this level of achievement is continuing as we move up to the records of our more recent graduates. An analysis of the class of 1938 is representative, since this group has been in professional work for 15 years—a period in which engineering graduates usually "settle down" fairly well to the pattern they will follow for their carees. It should be noted, however, that the normal experience for this class suffered severe disruption through most of this time with war, hot and cold, and various adjustments in our economy. Nevertheless a strong pattern of successful performance has taken shape for this group.

From an analysis of information received from something over half of the class (all divisions of engineering) the following summary can be derived:

Graduates in Engineering Design, Research, Development, and Consulting	36%
Graduates in Management (of Technical Enterprise)	43%
Graduates in Engineering Sales	12%
Graduates in Engineering Teaching	4%
Graduates in Non-Engineering	5%

The information lacking from the other portion of the class might change these percentages somewhat —possibly would increase the non-engineering category for example. Nevertheless, analysis of a number of other classes indicates relatively the same kind of breakdown, so it seems reasonable to assume that this is fairly representative of the class profile.

The categories listed are necessarily broad; how do we interpret them in terms of performance? First of all, the management category would seem to be generally recognized as a measure of success. It is true that a management or administrative post does not always call for the exercise of exceptional engineering talent in the technical sense, but it is also true that most engineers who achieve such positions do so because of superior performance as engineers and demonstrated ability for leadership. So we have over 40 per cent of this group in positions of management responsibility. It should be emphasized that this category was restricted to those in technical enterprises—not department store managers, for example, but production managers, general managers, and officers of manufacturing enterprises involving engineering development or operation, general contractors, etc. Among this group are no less than six presidents and five executive vice presidents of organi-

(Continued on page 56)

—*Loveless Studios*

Director Christensen

Civil Engineering at Cornell

by N. A. CHRISTENSEN, Director
School of Civil Engineering

On the following pages is a series of articles, of which this is the first, written by the directors of the various schools of engineering and architecture at Cornell. In them we bring you a brief sketch of the broad range of academic pursuits available in these schools.

In the decade of 1860, at the beginning of the great movement to make higher education more practical, Cornell University was born and from birth became one of the leading institutions of higher learning. It has never lost this position of respect among the universities of the world. At its founding, the School of Civil Engineering was one of the charter members of the Cornell Engineering Schools; from the halls of this school have flowed thousands of graduates into all parts of the world and into all kinds of engineering work. Many of its graduates have helped to establish and staff other engineering schools throughout the world, and the total effect of its alumni upon the engineering profession has thereby been magnified.

The foundation of the Civil Engineering training, like other types of engineering, is a sequence of mathematical and scientific courses. This sequence begins in the freshman year and continues throughout the entire five-year period. The early courses in physics, mathematics, chemistry, and mechanics are taught as service courses by the respective departments in the University. This basic training prepares the student to enter the design and applied science courses given by the seven departments of the Civil Engineering School. Each of these departments provides fundamental training in its particular field. In-

Civil Engineering students practice surveying techniques on the Cornell Quadrangle.

—*Alan F. Cohen*

dicating the nature of the subject matter provided by each, the names of these departments are: Drawing, Surveying, Hydraulics, Structures, Sanitary Engineering, Transportation, and Administration.

Some of the distinctive feature of the Civil Engineering curriculum at Cornell are these:

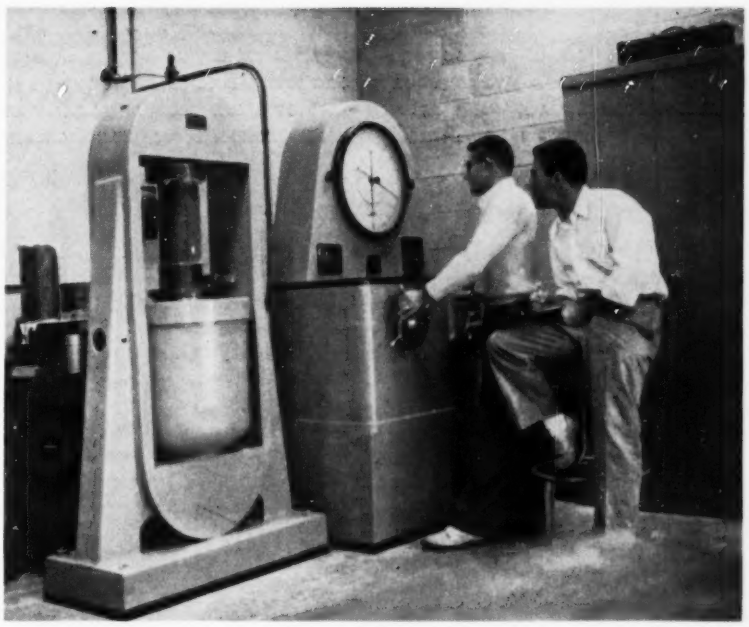
1. The drawing courses, while basic, are also adapted especially to civil engineering work. The drafting of structures, water supply systems, maps and survey data, and highway and airport designs require more than basic mechanical drawing ability; this extra knowledge can be gained at Cornell in the special drawing courses for civil engineers.

2. The five-year program at Cornell permits a more complete training in surveying, hydraulics, structures, sanitation, and transportation than is available in four-year schools. The future leaders of the civil engineering profession must have basic competence in each of the seven areas in order that the growth of their career after graduation may not be hampered. Five years are necessary for adequate undergraduate coverage of these several areas of subject matter.

3. A balanced program of subjects in the administration field is another feature of the Civil Engineering curriculum. General economics, engineering economics, accounting, money and banking, public speaking, engineering law, history, industrial and labor relations, and public administration are some of the courses required of undergraduates which round out this part of their training. The adoption of the five-year program has made these vital subjects available to our students. The frequency with which our Civil Engineering graduates rise to executive positions supports the wisdom of including this administrative work in their training.

Each of the seven departments participates in a program of graduate work. There are thirty-five graduate students now enrolled, taking graduate courses and doing research work toward both the M.S. and Ph.D. degrees. Graduate courses and research can be grouped into six fields as follows:

1. Drawing, cartography, geodesy, photogrammetry, and aerial photographic studies.
2. Fluid mechanics and hydraulic engineering.
3. Sanitary science and sanitary engineering.
4. Structural and soils engineering.
5. Transportation engineering.
6. Management engineering.



—*Alan F. Cohen*

Students in concrete testing laboratory operating a compression testing machine capable of producing a 100,000 pound load.

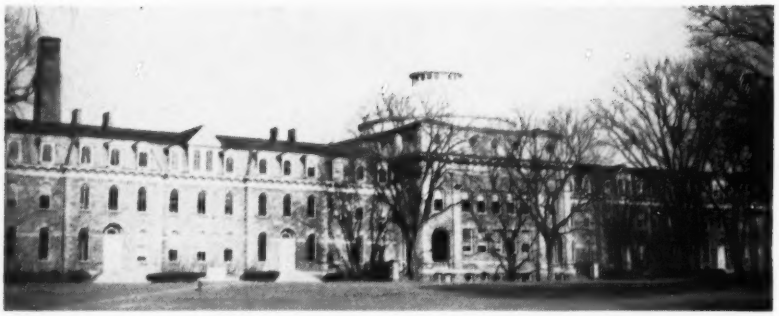
Each graduate student is treated individually. In consultation with his special committee, he selects his own program to fit his needs and to satisfy the University standards of competence. The graduate student frequently will elect supporting courses from other parts of the University. The wide choice of subject matter available to the students makes it possible to "tailor-make" course and research programs to fit almost any student, regardless of what his special interests may be.

The job opportunities for Civil Engineer graduates are widely varied. A quick glance at the graduates of the last five years indicates that many were in the reserve officers program and therefore entered upon their term of military service immediately upon graduation. After three years, however, most of them have returned to civilian status and are working in such fields as construction, design, education, sales, administration, or consulting. Most are employed by contractors, consulting engineers, industries, sales organizations, universities, or governmental organizations; but some are self-employed in their own business. The large majority serve in the United States, but many have spread throughout the world in the pursuit of their profession.

There is great variation in the monthly salaries received by our graduates. The following table from the alumni records will give a rough idea of the salary situation at this time.

Monthly Salaries	Years Since Graduation				
	1	2	3	4	5
Average	333	353	396	492	541
Median	333	358	400	465	500
Median of top half	409	416	433	525	600
Median of top quarter	425	460	483	600	709
High	583	465	833	1500	1666

It is interesting to note that usually graduates do not take the job with the highest salary but try to select the one with the greatest promise for service. The faculty of the School of Civil Engineering hope this will continue; we will want a few graduates to return to Cornell as teachers.



Sibley Hall, home of the School of Mechanical Engineering.

—*Matthew Starr*

Mechanical Engineering

by H. J. LOBERG, Director
Sibley School of Mechanical Engineering

The M E School, boasting a luminous history, fosters professionally-and community-minded citizens

It is difficult to compress the 85 years of colorful history of the Sibley School of Mechanical Engineering into a few words. There are too many dates, too many names of distinguished educators and engineers, too many prominent alumni—both young and old—too many innovations that became standard practice or objectives in engineering education to give justice to the impact of Sibley on the field of study known as mechanical engineering. A few highlights can only be suggestive.

The Morrill Act of 1862, leading to the land grant colleges of this country, with its specification among other objectives of . . . "teach such branches of learning as are related to agriculture and the mechanic arts" started the development. Dr. Robert H. Thurston (1885-1903), pioneer engineering educator and first president of the American Society of Mechanical Engineers, a scientist and experimenter developing the concept of the experimental laboratory, constantly raised the level of training for engineers. He, perhaps more than any one man, shifted the emphasis from mechanic arts to the profession of mechanical engineering, not only for Sibley but for all engineering schools in the country.

Dexter S. Kimball (1899-1937), with his offering in 1904 of the first course in this country in production management and its subsequent expansion into the field of industrial engineering, is recognized as an outstanding leader in his time. Paired with Kimball was Herman Diederichs, who did so much to expand and improve experimental and laboratory work.

Director Loberg

Dean S. C. Hollister (1938-present), who has led the country in its present reappraisal of engineering educational objectives and under whose guidance the present five-year program was started, is, like his predecessors, having a profound influence on the educational program for engineers.

These are but a few names and some of the concepts that have established the reputation of the School. Like a sturdy oak, the past has developed a strong root system to give life and vitality for the present and future growth. A study of the past and a knowledge of the present show that the objectives have always been to train a superior mechanical engineer with a basic foundation that leads to leadership in this important field of work.

A constant appraisal of what is being done and what needs to be

done to prepare a young man for a full and useful life in industry and society is always underway. Although at times the changes have been revolutionary, many have been evolutionary. Shifts in course structure, development of effective teaching aids, inclusion of new material as science and engineering forge ahead result in steady improvements in the training program. The vitality of the present-day staff, with their dedication to effective education and their widespread interest in basic research kept in balance with our underlying objective of being an outstanding educational unit and not a research institute, gives one confidence that the future will be as promising as the past.

The ME Student Today

The graduate of today cannot be compared with his counterpart of 50 years ago except that he is alike in one important aspect. They are both qualified in their basic training to further the science and art of engineering and to assume leadership in industry, education, and engineering.

The outstanding record of Sibley men in the past is ample evidence of the value of the program they studied. With age and maturity have come many honors and recognition to this group. Reports on the more recent graduates have been glowing; they are establishing themselves rapidly. The evidence points very clearly to the young men's ability to reproduce the success of their predecessors, even though the educational mold has been changed to match the needs of an ever growing and expanding field.

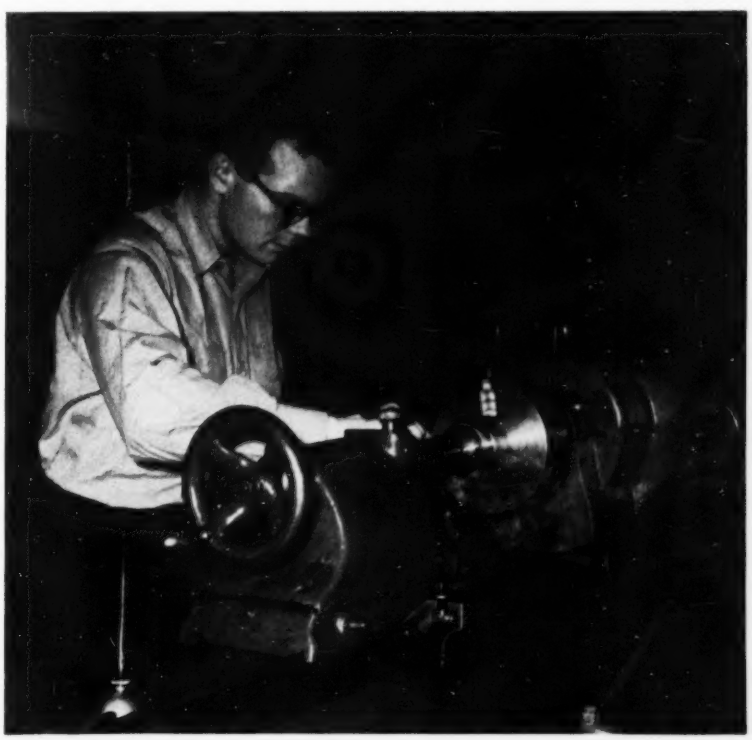
The scope of the present-day program can be visualized to some extent by a careful study of the curriculum and the coverage given in the various courses as outlined in the Announcement of the College of Engineering. Catalogs are rather sterile at best, however, and fail to indicate the depth of training given, the interrelation between courses, and the overall value of the experience and training a young man receives. It is difficult to get down on paper the personalities of all the teaching staff who influence in many ways the undergraduate. It is even more difficult to describe the character and quality of the student body. We are proud of our undergraduates. They take a rugged but not impossible training in a professional atmosphere and, at the same time, exert their leadership in the many extra-curricular activities that are ever-present on a university campus. A few illustrations will give a glimpse of their quality: This year about one third of the fifty fraternity house presidents are M.E.'s; one third of the Cayuga's Waiters, a select singing group, are M.E.'s; all athletic teams are well represented including the captains of football and track—to name a few. As a student body, they represent less than ten per cent of the male undergraduates, but their participation exceeds their numerical strength. Briefly, this indicates why their overall training at Cornell produces balanced, promising individuals.

In graduate work and research, Sibley is keeping pace with the times and the demands of the future. Ten major research projects, sponsored by industry and government, challenge twenty staff members of the rank of assistant professor or higher, on a part-time basis. The forty-six fifth-year projects are similar in their exploration of things not known. All this probing for the new and unknown is done on a part-time basis so that its value is felt immediately in the classroom. A healthy respect for the importance of research has not led, however, to the separation of teaching and research. We are primarily an educational institution.

This very brief review of some aspects of Sibley falls short of telling the whole story. Men, both staff and students, ideas, and principles give vitality and direction to any organization. The physical plant is needed to house these important elements, but buildings and equipment alone do not produce. When one becomes familiar with the work that is going on within the buildings and one learns to know the excellence of the student body, he appreciates not only why Sibley has such a solid and well established reputation based on the past, but also why the future holds so much promise.

Lathe practice in introductory machine tools course.

—Stephen Beck



Electrical Engineering

by C. A. BURROWS, Director
School of Electrical Engineering

Diversification in fields both liberal and technical keynotes the EE curriculum

—Cornell Photo Science

Director Burrows

The best educated man has been defined as he who can fit himself into the greatest number of places. While engineering schools have often been considered schools of specialization, it is the policy of the School of Electrical Engineering at Cornell to produce not just a specialist, but a student who can, at graduation, qualify under this definition.

The School of Electrical Engineering takes advantage of the fact that it is a part of a great university by providing a variety of subject matter in its curriculm. A liberal amount of free electives may be taken in the various departments throughout the University. The curriculum is well balanced among the humanities, basic sciences, applied sciences, and other engineering subjects as well as those of electrical engineering.

The research program of the school provides the faculty with current illustrations for use in teaching the principles of electrical engineering. These may be drawn from radio wave propagation and radio astronomy for the fundamental principles. Illustrations for the more advanced engineering principles are available from the research in servomechanisms and vacuum tubes. Research in high voltage phenomena and illumination also help to keep undergraduate teaching up to date. In addition to the fine laboratories for instruction in these subjects, the School is well equipped with laboratory facilities in electrical measurements, rotating machinery, basic electronics, radio communications, industrial electronics and pulse techniques. Not only are elective courses in these subjects available to the undergraduate, but courses are also offered in transistors and electronic computers.

In his fifth year the student carries out an individual project of his own choice in one of these areas of electrical engineering. A well devised plan for carrying out the project is submitted to his professor in writing for approval or necessary modification. The experimental and theoretical work involved is then performed by the student. Finally the results of these findings form the subject matter for a thesis that he submits for credit in the course.

Through the medium of these subjects, the student is trained to think independently, to communicate the results of his original thought, and to discriminate among relative values. The difference between this education and other liberal disciplines is that electrical engineering is used as a medium to develop the thinking process. By this means the graduate has not only acquired a liberal education but also the tools necessary to enter his chosen profession.

Students constructing an amplifier in a communications shop course.

—Ray Simon

—*Ray Simon*

Electrical engineering students in the laboratory construct a magnetic amplifier.

Development

(*Continued from page* 10)

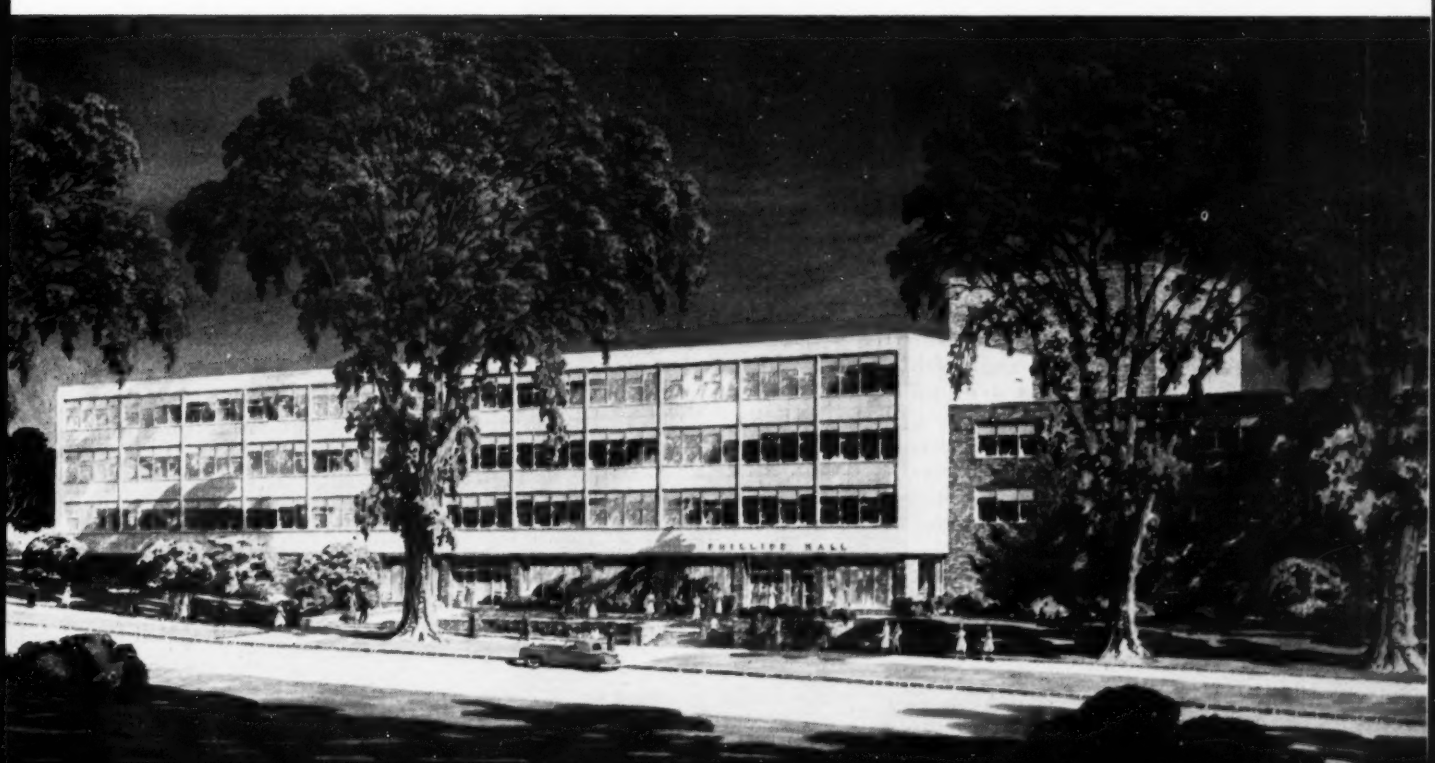
of materials processing of the Sibley School of Mechanical Engineering and the second housing the department of Mechanics and Materials.

The School of Electrical Engineering has not been alone in pioneering in education and research. Other schools of the College have made their proportionate contributions in their respective fields. In this year of celebration of the fiftieth anniversary of powered flight, we are once again reminded of the significant contributions made to this field alone by Cornell and Cornellians. In the Sibley School of Mechanical Engineering, a graduate student, Sanford A. Moss, in 1910 built the first gas turbine. He went on later to develop this important power unit on a practical and commercial basis.[1]

The Graduate School of Aeronautical Engineering is currently conducting research at supersonic speeds sufficient to produce shock waves involving such violent molecular turbulence as to become incandescent. Space does not permit here the recounting of other contributions of the College to knowledge in the various branches of engineering.

In 1944, the faculty of the College adopted the five-year undergraduate curriculum in all branches of engineering. It had initiated this type of curriculum in Chemical Engineering in 1938. With the intervention of the war further developments in this line had to be postponed. The program became effective in the fall of 1946. The graduates of this important new form of curriculum have already demonstrated the superior quality of this form of training. Industry in the engineering field has been quick to recognize the advantages of such a program and of the superior abilities from the graduates from it. The program has clearly demonstrated the opportunities that it offers to those who are looking for a superior engineering education and for the development of leaders that such a program achieves.

[1] For more about Cornell's role in the story of powered flight see THE CORNELL ENGINEER, Dec. 1953.



Architect's drawing of Phillips Hall, now being erected to house the School of Electrical Engineering.

Chemical and Metallurgical Engineering

by F. H. RHODES, Director
School of Chemical and Metallurgical Engineering

Graduates from these challenging curricula rise to positions of responsibility in expanding industries

At Cornell the curriculum leading to the Degree of Bachelor of Chemical Engineering and that leading to the Degree of Bachelor of Metallurgical Engineering are administered by the School of Chemical and Metallurgical Engineering. The two curricula are almost identical in the first year; they differ in the second and later years because of the desirability of including courses that relate more specifically to the special field of interest of the student. In both curricula the primary purpose is to prepare men for really effective professional work in their chosen field.

In both metallurgical and chemical engineering the first two years are devoted primarily to the laying of an adequate foundation for the later work that relates more specifically to the professional field. The more strictly professional work is concentrated in the last three years. In these later years are included also those courses in history, public speaking, economics, and other subjects which afford the necessary background for administrative work in the chemical and metallurgical industries and which provide an understanding of the social and economic implications of the work of the engineer. In the last three years of the curricula there is also provision for a very considerable number of elective courses, which may be taken in any division of the University.

Graduates of the five-year course in Chemical Engineering at Cornell find employment in all of the various branches of the chemical industries, including petroleum refining, the manufacture of synthetic chemicals and dyes, the rubber industry, the manufacture of plastics, the production of acids, alkalies, and other so-called heavy chemicals, and the food and pharmaceutical industries. A considerable number of our graduates have also been employed by the Atomic Energy Commission and by private corporations engaged in the development and research work on the commercial application of atomic energy.

—*Photo Science*

Director Rhodes

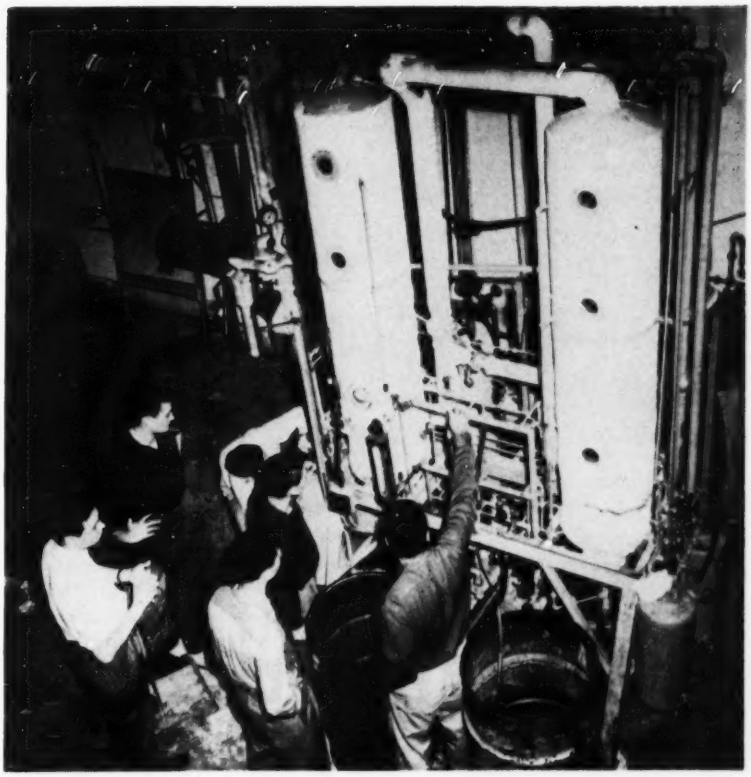
Most of the graduates in chemical engineering enter immediately into research and development divisions of the various companies, although many are employed directly in technical sales and in plant operation. Most of these men are advanced to positions of administrative and managerial responsibilities within a remarkably short time after graduation. A recent survey shows that approximately 85 per cent of the graduates in chemical engineering are, within about three years after graduation, in administrative positions in which their work involves primarily the organizing and directing of the work of other men. This does not, of course, mean that these graduates are not still engineers; it means that their engineering training is applied in positions of administrative and executive responsibility.

The graduates in metallurgical engineering find employment in the steel and in the non-ferrous metal industries, as well as in foundry work and in the other metal industries. There is also a large and growing demand for metallurgical engineers in the process and fabrication industries, where they serve primarily as consultants in the selection or the development of special metals and alloys for special conditions of service. Most of the metallurgical engineers, like the chemical engi-

neers, go directly into research and development divisions of the various companies, but are advanced with unusual rapidity to positions of administrative responsibility.

The demand for Cornell chemical and metallurgical engineers is far in excess of the supply of graduates in these fields. In June of 1953 the ratio of available openings to the number of graduates reached the fantastic figure of about thirty to one. Present indications are that this ratio will be even higher in June, 1954. The supply of trained graduates in these fields probably will not meet the demand for at least ten years; there is considerable evidence that the need for trained chemical and metallurgical engineers will increase very markedly during the years to come.

Both chemical engineering and metallurgical engineering offer special advantages as fields for professional work because of the opportunities for employment and advancement in any of the three major avenues of research, management, or sales. Monthly starting salaries for five-year graduates from the five-year courses in chemical and metallurgical engineering at Cornell in June, 1953, averaged $405; this was about $45 above the national average for chemical engineering graduates from approved four-year schools and was equal to or slightly higher than the average salary for chemical engineers with a master's degree. Top salary for five-year graduates in chemical engineering was $435, which was also about the upper limit for men with master's degrees throughout the country.



—*Evan Zelin*

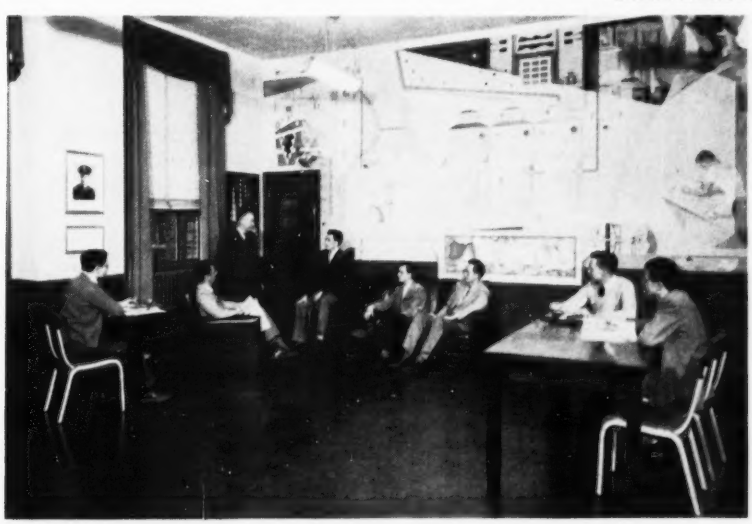
As an experiment in an advanced Chemical Engineering course, students attempt to bring a rather obstinate double effect evaporator to equilibrium.

The School of Chemical and Metallurgical Engineering at Cornell is rather unusual in the very close personal association that exists among the students and between the students and faculty. The individual students and members of the staff of instruction know each other personally and every student in the School feels free to approach any member of the faculty with any problem that may confront him. This close mutual acquaintance has encouraged a spirit of solidarity, not only among the young men in the courses here, but also among the graduates of the School.

In conclusion, the School of Chemical and Metallurgical Engineering at Cornell is organized and conducted for the primary purpose of preparing capable young men for effective professional and administrative work in the chemical and metallurgical industries, and is very keenly aware of its responsibility to provide the most effective training to this end. The whole effort of the school is directed to the primary objective of providing the best possible training, not only for the work immediately after graduation, but for the responsibilities to which the graduates may advance later.

Chemical Engineering students enjoying the lounge in Olin Hall, home of the school.

—*Cornell Photo Science*



Director Smith

Engineering Physics

by L. P. SMITH, Director
Department of Engineering Physics

The newest of Cornell's engineering schools was established to fill the needs of an expanding technology -- trained engineers who are capable of handling problems arising in basic science

In 1946 the Cornell program in Engineering Physics was originated. It represented a new and carefully studied attempt to provide a highly integrated course of study and training which would furnish the student with a solid foundation in the physical sciences amalgamated with a knowledge of the properties of materials and certain fields of professional engineering. The objective of this program was to prepare a student adequately for a career in industrial research and advanced engineering development in a world in which technical equipment and operations are rapidly becoming more and more complex and in which the rapidity of technological progress requires that the advanced development engineer rely heavily on basic science and a comprehensive knowledge of the atomic structure of materials.

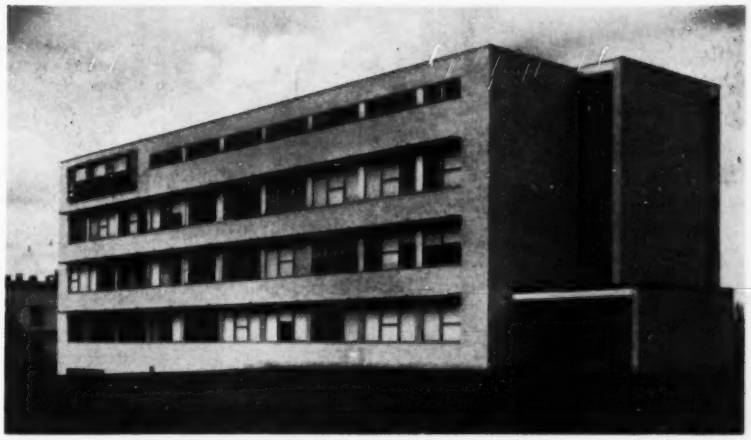
Success in meeting the technical objectives of such a program and at the same time providing the means by which a student can develop creativeness, technical judgment, the ability for independent accomplishment, and a keen sense of the correctness of things depends on many factors. First and foremost is the faculty. This must be made up of good teachers of many technical fields who for the most part are actively contributing to knowledge through their research in their fields of interest, those who have first-hand experience in applied or industrial research and are keenly interested in the Engineering Physics type of training. Cornell University has a faculty in Engineering Physics which meets these qualifications.

Next comes the quality of students. They are selected carefully to insure as far as possible their successful assimilation of the training. The student must possess talent in this field, but experience shows that this is by no means sufficient. He must have a will to acquire the subject matter of the curriculum through hard work and self-sacrifice. The acquisition of a technical training such as that envisaged here is never easy, but it is very rewarding for those who develop competence. From its inception there have been such students enrolled in this program, and the number of

qualified applicants for admission has steadily increased.

The curriculum itself is a very important factor. It should contain the appropriate amount of physics; mathematics and chemistry; a strong offering in the properties of materials, such as atomic structure of liquids and solids, physical metallurgy, etc.; and finally a well selected group of subjects in engineering practice. These subjects must be intimately interwoven and highly integrated. The Cornell curriculum has been devised with care in these respects and is under constant study in order to provide the best training possible. It is very important that the curriculum not be hampered by boundaries between University departments or between the College of Engineering and the College of Arts and Sciences. Fortunately it is not so hampered at Cornell.

Another important matter is to achieve close association of the students with members of the faculty, especially in the more advanced phases of the curriculum. It is highly desirable that the student learns in some degree how members of the faculty think and contribute to new knowledge in their respective fields. This is made possible by smaller advanced classes and fewer numbers in laboratory groups. It is particularly enhanced by the project work which each fifth-year student conducts under the supervision of a staff member. The project develops the student's independent thinking, his creativeness, and overall research sense. The following list of projects taken at random throws a good deal of light on the subject matter and scope of training of the student in Engineering Physics:



—Alan F. Cohen

Newman Labratory houses the department of nuclear physics, in which EP students may do research.

Development of a Microtome for the Electron Microscope.

Design and Construction of a Stable Negative Resistance for Computer Use.

Study of a Ward-Leonard Positional Control System.

Development of Theory for Scattering of Radio Waves by Atmospheric Turbulence.

Soil Density Measurements by Gamma-Ray Scattering.

Study of Dynamic Elastic Properties of Metals under High Stress.

Study of Mathematical Techniques in Hydrodynamics.

Study of Torsion in Thin Plates.

Investigation of the Endurance of Aluminum Alloys at Elevated Temperatures.

Construction of a Digital Computer Using Magnetic Cores.

Study of Time Delay of Plastic Deformation in Metals.

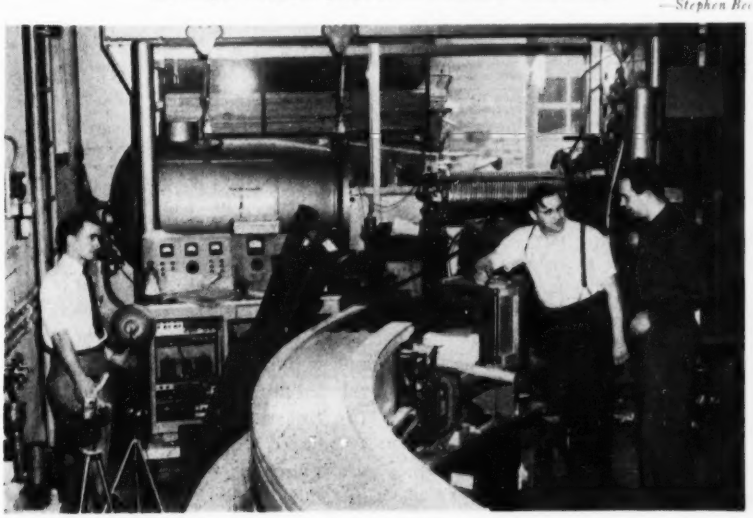
Many more examples could be cited, but this begins to furnish a cross-section of the type of projects.

The crucial test of the success of the program rests entirely on the quality and competence of those who graduate as Bachelors of Engineering Physics. To date 47 students have received this degree. A considerable number have been enthusiastically accepted in the leading graduate schools of engineering or science in the country. Others have gone into industrial research and development. The reports from graduate schools and employers which have been received thus far indicate that the program has achieved a marked degree of success since it was started.

At present there are 152 students enrolled in the Engineering Physics program. When these students graduate they will not nearly fill the industrial demand for students with this type of training. We are proud of the record achieved by the students who have graduated as Bachelors in Engineering Physics. The Department of Engineering Physics is striving to provide students with the best possible training in this new field.

Construction work in progress on a new three-billion-volt synchrotron, which is one of the major research projects in Newman Laboratory.

—Stephen Beck



The College of Architecture

by T. W. MACKESEY, Dean
College of Architecture

A carefully selected, spirited group of students is intimately exposed to all types of architectural philosophy

The program in Architecture in the College of Architecture is thoroughly professional in concept and in organization. There is but one core program which has but one objective—to train young men and women who will one day be practicing architects and leaders in the profession.

From the first organization of the new University which was conceived by Ezra Cornell and Andrew Dickson White, instruction in architecture was contemplated. White had included architecture among the subjects of instruction proposed in the University's plan for organization in 1865, and by 1871 a Department of Architecture was in operation. This was the first school of architecture within the framework of a genuine university in this country.

President White's personal library included what was probably the largest and finest collection of architectural books in America. This collection became the core of the library of the College of Architecture, which still ranks among the finest of its kind in the country.

Architecture is a complicated profession. The architect must be an artist and an engineer; he must have considerable knowledge of real estate, economics, and law; he supervises the disbursement of large sums of other people's money and must be a business man; and in order to get commissions he must be a good salesman. He must have an understanding of the world he lives in and the environment his buildings help to shape.

—*Cornell Photo Science*

Dean Mackesey

A major problem faced by all schools of architecture is how to provide training on such a broad front in the normal span of college years. At Cornell two basic decisions have been made in this connection. As far back as 1922 Cornell extended the undergraduate program in architecture to five years. This was a pioneering and radical move at that time. Other schools soon began to follow suit, however, and at the present time no school with a program of less than five years will be recognized by the national accrediting agency in architecture.

The second basic policy on which we have decided is to concentrate on fundamentals of design and construction during the school years and to leave some of the other things, in which we recognize the architect must have some competence, to be acquired by office experience after graduation.

Two main threads run through the entire five-year program—the sequence of mathematics and engineering courses and architectural design. The student begins the study of architectural design on the first day of classes in his first year and continues it every term for five years. The work in design is entirely by the problem method and is highly competitive. Student designs are judged by a jury of the faculty and are ranked in what appears to the jury to be order of merit. Some of the schools of architecture in this country operate on the "master and disciple" principle. A famous designer and teacher is set up as the master with a group of lesser men about him as dis-

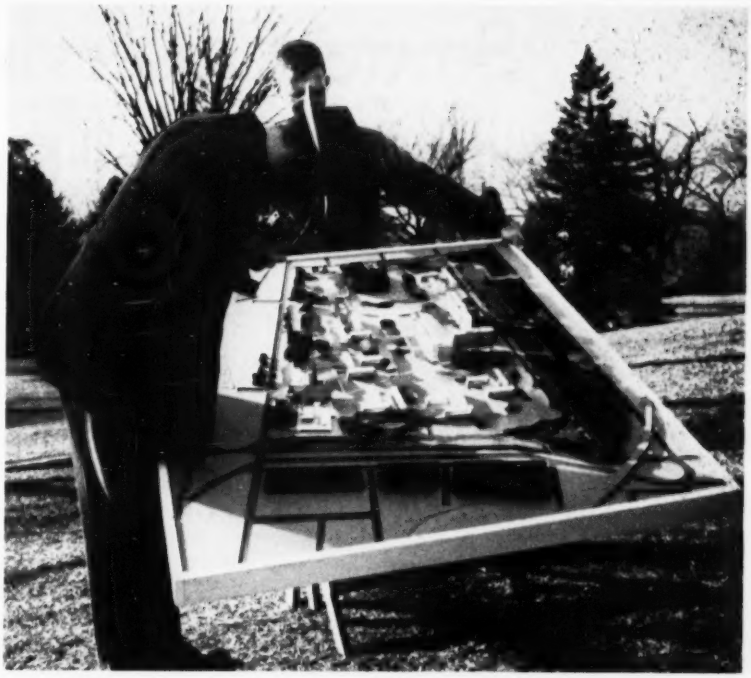
ciples. One philosophy, one approach, is taught and all faculty members and students must conform to the party line. We have no party line at Cornell. As a matter of conscious policy we have rejected the master and disciple approach. We try to expose our students to all of the current philosophies of architecture and to encourage them to develop their own approach and style.

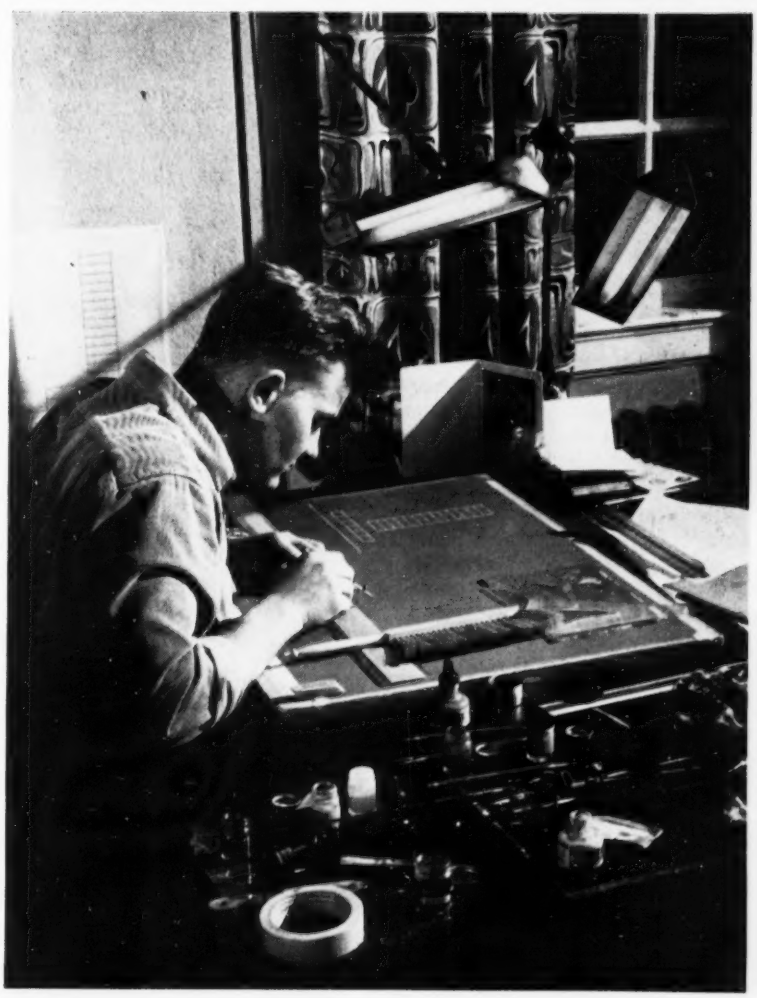
In keeping with this policy we have inaugurated a system of "Visiting Critics." We invite practicing architects who are doing significant work to join us for four or five weeks at a time. These men, who have left demanding practices, lead our fourth-year class in the study of some architectural problem. One of these Visiting Critics follows another throughout the entire school year.

The curriculum includes the equivalent of one full year of free elective work. This is not concentrated in one year, but is spread through the entire program in order to permit a student to follow through and take advanced courses in a field in which he may have developed a special interest.

Only forty-five students a year are admitted to begin the study of Architecture at Cornell. The small classes permit us to continue the individual, shirt-sleeve, over-the-drafting-board instruction that has proved itself so successful in the past. Because of the small size of our student body and because of the intimate relationship between students and faculty, there exists in White Hall a rather intensive esprit de corps. That spirit occassionally assumes a somewhat bizarre form, but generally speaking it is all to the good.

The program in Architecture is the principal program in the College of Architecture. The College does operate, however, related undergraduate and graduate programs in Landscape Architecture, City Planning, and Painting and Sculpture.





***Above*: An Architecture student shows a model he constructed as a classroom project.**

—Alan F. Cohen

***Right*: An Architecture student works at his drawing board in his room.**

—Harry Schlaifman

Some Observations Concerning The Collegitron

by THOMAS REED, M.E. '56

PURPOSE: The evaluation of an incident particle exposed to a variety of fields.

EQUIPMENT: Source of radiation emitting several thousand particles per year; Collegitron(described below) adjusted for concentrated bombardment at all stages with a variety of fields but allowing the incident particle complete freedom of action; and lastly, means of observing changes of the initial particle after transversing the reactive fields of the Collegitron.

TIME FOR REACTION: Four or five years.

DISCUSSION: A source of active, high quality particles will be placed at the entrance to the Collegitron. The model of this machine developed at Cornell is unusual since it first of all has a myriad of fields that subject the particle to stresses and conditions deemed either undesirable or unobtainable in similar contrivances. Secondly, the particle has complete freedom of action while making its run. Some go wild and must be removed less they damage the delicate balance set up, but the majority make the entire run and find that due to the high field intensities and speeds involved, self evaluation is nearly impossible until ejection from the discharge nozzles.

DATA: First stage, over 2000 particles enter. All subjected to similar high group pressure. Some become highly erratic in response to these forces, emerging with a heavy layer of grey flannel, but the majority maintain their equilibrium. Over half of these incident particles are subjected to rushing. Several try to change their appearance, resulting in high stresses and unsatisfactory adjustment, but the majority make an effort to retain their basic properties. At this time 100 per cent are placed in the academic field. Resisting forces increasing exponentially with time are encountered by all those who will not make the required effort. Consequently, sufficient delay in this field will build up resonance and necessitate ejection. Particles must make this field one of prime importance. Also during the first and most difficult stage all the particles under consideration are subjected, sooner or later, to treatment with ethyl alcohol. Many develop an affinity for same. This latter group will not be ejected, providing minimum academic standards are met, but further treatment is useless and therefore wasteful. In addition, strong interactions are set up due to the numerical disproportionality between the number of males and females. Males closest to equilibrium don't let it discourage them, best females don't let it go to their heads.

Second stage treatment involves the use of delay chambers. Errant particles whose direction is uncertain or whose momentum is low are

A would-be scientist entrapped between conflicting fields of the Collegitron.
—A Stuckelman Original

THEY STARTED OUT EVEN AT GRADUATION:

Why is one doing better now?

You may not see it in their outward appearances – but there's a big difference between these young men. One has held three jobs in the five years since graduation. He's still looking for a job that offers him a lifetime career. The other has been with a Bell Telephone Company during that time. He's on his way up!

Seventy-five per cent of college men hired by the Bell Telephone Companies since World War II are still with these telephone companies after five years! Here's why:

Telephone Work Is Interesting – As an engineer, you'll be planning telephone facilities or supervising construction, installation and maintenance. You'll work with the newest developments in electronics and communications as you help expand and improve the world's best telephone service.

There Are Places to Go – Each year the number of college people hired is related to estimates of the number of future management positions expected to be available. We are looking to the future – yours and ours.

You Grow with a Growing Business – The Bell System is one of the fastest growing businesses in the world. Since the end of World War II, it has spent about nine billion dollars for new construction. The past five years have seen the introduction of network TV transmission, dialing of Long Distance calls and the development of the remarkable transistor.

You'll Be Happy – Not only because of the interesting and rewarding work, but for many other reasons. For instance, Bell Telephone Companies are located in all parts of the country. So you may be able to start where you want to live. And what about salaries? It is the basic policy of the telephone companies to pay salaries that compare favorably with those positions of similar responsibility in other fields.

No matter what your military status, it's worth inquiring about Bell System employment opportunities. Your Placement Officer has the details. And be sure to talk to our employment representatives when they visit the campus. The time to plan your future is now!

BELL TELEPHONE SYSTEM

The design engineer trained in welded steel construction is best able to meet industry's need for low cost manufacture because

WELDED DESIGNS CUT COSTS 50%

BY using steel instead of cast iron, design engineers today make their products more efficient . . . *many times at half the cost.* Product designs are stronger, more rigid, take less material to build.

Too little attention is usually devoted to simplification of product designs to eliminate costly manufacturing manhours once a basic design is established. Where designers reappraise product details for welded steel construction, production costs are being cut an average of 50% compared with manufacture using castings.

Manufacturing operations are simplified with welded steel design. Rejections due to inferior metal are eliminated. Less machining and finishing are required. Finished machines are streamlined, more modern in appearance.

In the example below, an economy-minded design engineer lowered manufacturing cost on a machine arm and cut weight of the arm.

Before conversion to steel, the machine arm required 182 pounds of gray iron and cost $38.25 to cast and machine. Welded steel design weighs only 86.8 pounds . . . costs $20.06.

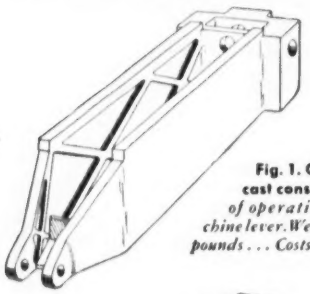


Fig. 1. Original cast construction *of operating machine lever. Weighs 182 pounds . . . Costs $38.25.*

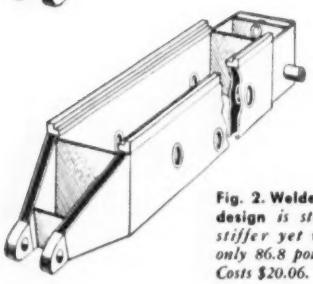


Fig. 2. Welded steel design *is stronger, stiffer yet weighs only 86.8 pounds . . . Costs $20.06.*

DESIGN DATA *for welded construction is available to engineering students in the form of bulletins and handbooks. Write*

THE LINCOLN ELECTRIC COMPANY
Cleveland 17, Ohio
THE WORLD'S LARGEST MANUFACTURER OF ARC WELDING EQUIPMENT

here entrapped either for ejection or, more often, for final disposal at the end of the process as inert material. The shingle and key chamber draws out those who are aimed only at the artificialities. It is at times difficult to differentiate between those who are sincerely interested in the welfare of the campus community and those who seek only the honors, but the truth develops with time. A more efficient trapping device is the Ivy Room. Low energy groups are ensnarled here, hopelessly trapped in coffee, conversation, and cards. It is difficult to explain why some particles are caught, for a few that would appear to be at too high an energy level to be trapped spiral slowly at first, then more quickly into the routine. Eddy currents are found in this area, too. Known as the social whirl, they tend to misdirect and in some cases totally confuse some particles to the point of circling endlessly in search of security and recognition.

Third stage transformation involves exposure to thought rays. Secondary radiation from one particle to another results, raising the energy level of all those in the area. It is due to this treatment that the particles become useful and highly directional. Those that have made it this far and that respond to the treatment seem to realize the purpose of the machine. They are the eagerly sought equilibrium products that are finally discharged at the Senior Week nozzle. It might be added that at this time the delay chambers are also emptied and all high energy and inert products alike are placed in the receptacle marked "College Graduates." However, the successfully treated high energy products are unmistakeable.

CONCLUSION: A purely mechanistic approach will not yield an understanding of the Collegitron, as the incident particles show a freedom of choice peculiar to human action. We therefore may predicate the theory that the entering particle brings to the machine a degree of energy and breeding as well as an ability to make decisions regarding which fields to enter and for how long. Since these fields will undeniably and irrevocably change him, and since continued exposure to one type of radiation may have ill effects, some careful and previous thought on the subject would seem advisable for a successful trip through the Collegitron.

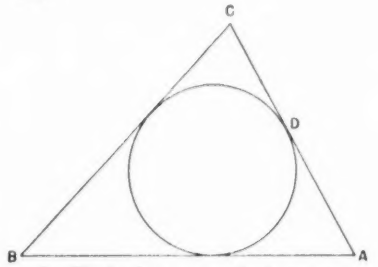
Who's Got Papyrus?

Conducted by Robert Kantor

As we promised, we are offering a prize of three dollars to the first person who submits the first set of correct solutions to all the problems on this page. The answers may be written on papyrus, cardboard, stationery, or paper towels, in ink, paint, blood, pencil, or type. Spanish and German are both understood by the department although English is the preferred language. The sole criteria which we are imposing are that the solutions, and the methods by which you obtain these solutions, are correct. Now doesn't that sound simple?

1. What is the largest number of sections into which an orange can be cut, using four straight strokes of a knife? (Do not separate the sections after each cut.)

2. Given: circle inscribed in triangle ABC. AB=60, BC=55, AC =40. D is point of tangency. Find the product of the lengths AD and DC.

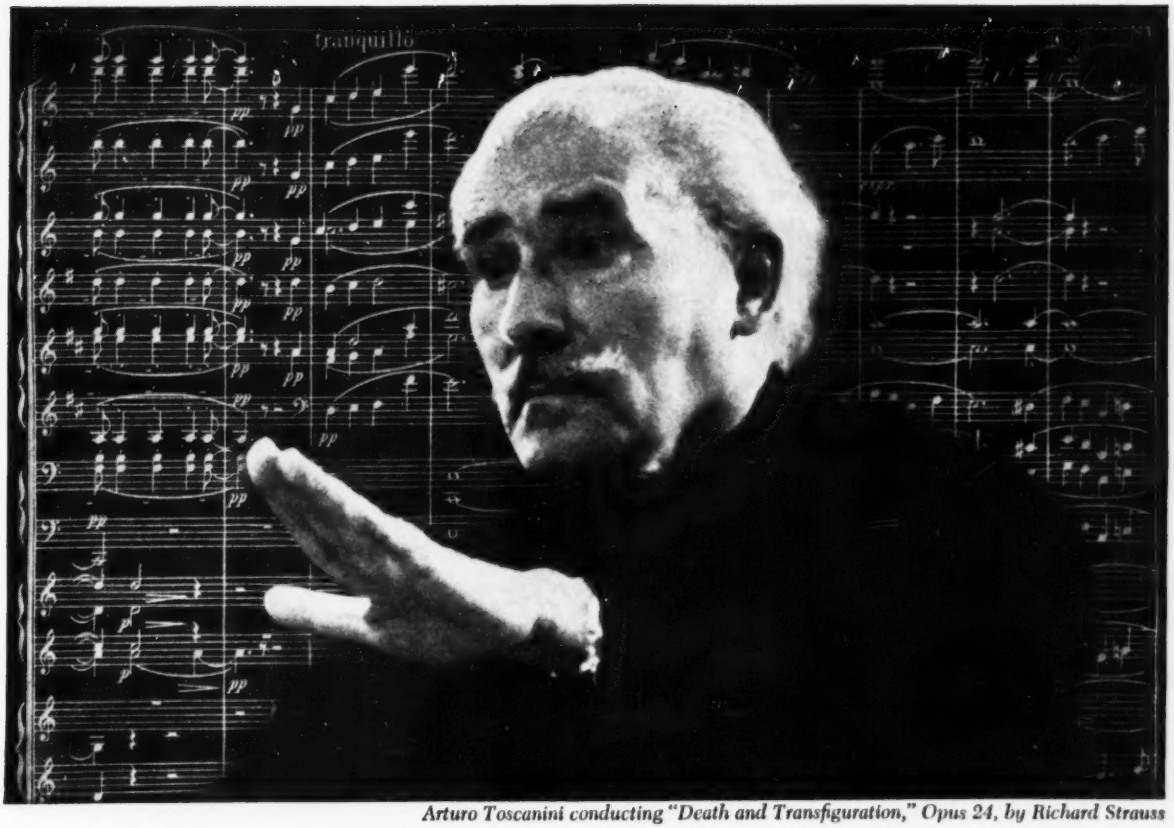


3. Find the sum of the squares of the first hundred integers,

$1^2+2^2+3^2+4^2+5^2+6^2 - - +99^2+100^2$

by deriving a formula for the general case, i.e.

$1^2+2^2+3^2+ - - - - - n^2$



Arturo Toscanini conducting "Death and Transfiguration," Opus 24, by Richard Strauss

RCA High Fidelity brings you every musical note!

RCA Victor High Fidelity is the result of 50 years of leadership in recorded music, phonograph research and development of radio and motion picture sound. It is a new dimension in sound created by the perfect union of recorded music and the phonograph.

A genuine high fidelity instrument re-creates the full range of tones and overtones of the original composition—exactly as the composer intended. The precise balance of sounds from the highest to the lowest must be maintained if perfection is to be achieved.

"Victrola"® phonographs, Victor records, and "intermatched" high fidelity equipments for those who want to assemble their own units—all are designed to work together to bring the brilliance of the original performance into the home. Now, with RCA High Fidelity instruments, you can hear the full gamut of the orchestra—from the shimmer of the cymbals to the beat of the tom-tom. Your favorite music sounds just as if you were in the presence of the recording orchestra and artists.

True Hi-Fi—as in RCA Victor instruments and components—embraces the entire scale of tones from the rich lows to the colorful highs. Nothing is missing . . . the sounds reach the ear in their proper proportion and relation.

The nation-wide interest in high fidelity reflects a growing taste for the highest quality music. Developments by RCA scientists and engineers now let you enjoy this new musical experience. Visit your RCA Victor dealer and hear the new Hi-Fi models of "Victrola" phonographs, Victor records and "intermatched" components.

CONTINUE YOUR EDUCATION WITH PAY—AT RCA

Graduate Electrical Engineers: RCA Victor—one of the world's foremost manufacturers of radio and electronic products—offers you opportunity to gain valuable, well-rounded training and experience at a good salary with opportunities for advancement. Here are only five of the many projects which offer unusual promise:

- Development and design of radio receivers (including broadcast, short-wave and FM circuits, television, and phonograph combinations).
- Advanced development and design of AM and FM broadcast transmitters, R-F induction heating, mobile communications equipment, relay systems.
- Design of component parts such as coils, loudspeakers, capacitors.
- Development and design of new recording and producing methods.
- Design of receiving, power, cathode ray, gas and photo tubes.

Write today to College Relations Division, RCA Victor, Camden, New Jersey.

Also many opportunities for Mechanical and Chemical Engineers and Physicists.

RCA

RADIO CORPORATION OF AMERICA

World leader in radio—first in television

In SPORTS or BUSINESS

Wouldn't you rather be on the WINNING side?

The thrills you've known in sports —
the racy, heady feeling of knowing what it's like to win —
are close kin to the excitement of working with a company
which competes with its own achievements.

For Sikorsky's are winners —
engineered by men who never lose the thrill of winning.

Yet "winning" and breaking records are only by-products
in Sikorsky's never-ending quest of perfection.
Today the research departments, drafting rooms, engineering laboratories
are busy fitting this most versatile of aircraft
to ever more demanding military and peacetime uses.

Many engineering skills and abilities are needed.
Perhaps yours. If you are interested in an industry which has only
scratched the surface of its potentials, then Sikorsky may be for you. Promising
engineers find a good beginning — a winning future — at Sikorsky.
Write today to Mr. R. C. Banks, Personnel Department
for more information.

SIKORSKY HELICOPTERS

Sikorsky Aircraft, one of the four divisions of United Aircraft Corporation, South Avenue, Bridgeport 1, Conn.

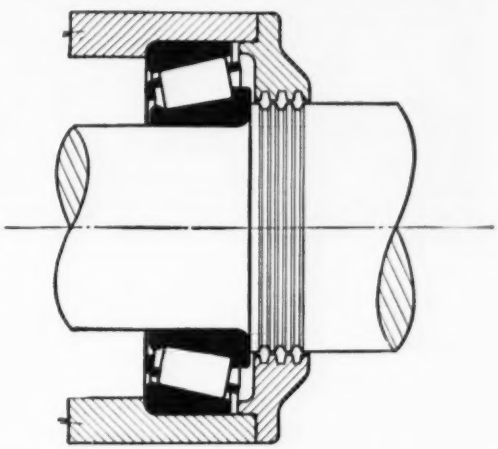
Another page for **YOUR BEARING NOTEBOOK**

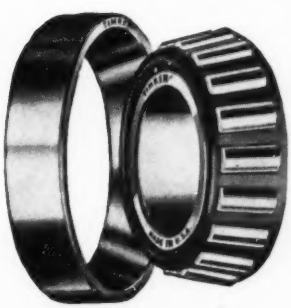
How to keep buried wheels turning smoothly

Hidden under the pile of dirt (see arrow) is a 4-wheel truck that backs up this ditch digger's whirling buckets. To prevent breakdowns, the wheel bearings had to be able to absorb the shocks of boulders and the digging action itself. And they had to be protected from the dirt. The engineers who designed this application licked both problems by mounting the truck's wheels on Timken® tapered roller bearings. Timken bearings absorb the shocks because they have tough, shock-resistant cores under hard, wear-resistant surfaces. And Timken bearings make closures more effective.

How TIMKEN® bearings help keep dirt out—lubricant in

Timken bearings make closures more effective because they hold the housings and shafts concentric. As a result, dirt can't get in—lubricant can't get out. Maintenance is minimized. Continuous, trouble-free operation is assured.



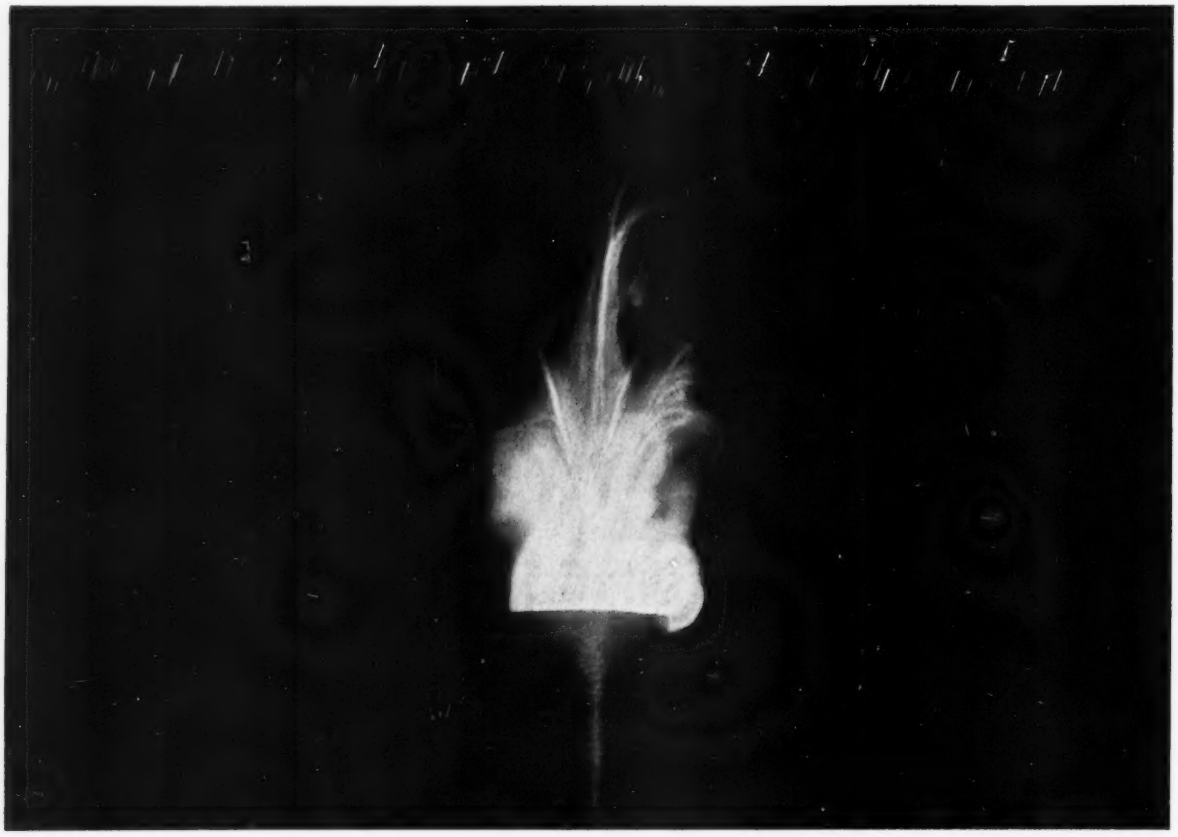


TIMKEN
TRADE-MARK REG. U. S. PAT. OFF.
TAPERED ROLLER BEARINGS

Want to learn more about bearings or job opportunities?

Many of the engineering problems you'll face after graduation will involve bearing applications. For help in learning more about bearings, write for the 270-page General Information Manual on Timken bearings. And for information about the excellent job opportunities at the Timken Company, write for a copy of "This Is Timken". The Timken Roller Bearing Company, Canton 6, Ohio.

NOT JUST A BALL ○ NOT JUST A ROLLER ⬭ THE TIMKEN TAPERED ROLLER BEARING TAKES RADIAL AND THRUST LOADS OR ANY COMBINATION



million watt spark plug . . .

Calling this jet engine ignitor a million watt spark plug is an understatement. Actually this picture shows a 1,500 kw discharge that occurred in 25 microseconds.

One of a series of photographs taken as we vary voltages and ignition system design, it helps us study the arc size and the penetration of the discharge into the combustion chamber. These and other studies provide the knowledge necessary for the design of dependable ignition systems — systems that will start combustion at 45,000 foot altitude and −65° temperature.

Good ignition is important. Yet ignition research is only one small phase of our development program.

But this work does suggest how completely we explore technical areas to produce dependable aircraft engines. And it illustrates the wide variety of tools and techniques we use to solve difficult problems.

Here, emphasis is put on "getting the facts" — *all the facts.* This makes good sense to recent graduates who want to do real engineering — explains why so many are attracted to a career at Pratt & Whitney Aircraft.

PRATT & WHITNEY AIRCRAFT

Division of United Aircraft Corporation

East Hartford 8, Connecticut

Extracurricular

Activities Feature in the Engineer's Life

by LAVONNE OLSON, ChemE '57

Just what does the engineering student want from his college years? The answer to this question also answers the very big question of what type of engineering college would be the best for you as an individual. If you want a strict engineering education, with a limited number of liberal electives and activities, with your outside associations limited to other engineers, your choice of a college would be the technical institute. Should you instead want a broader, though still technical, education, you would probably choose a university.

For many, the best means of relaxing from the many hours of mental exertion that are required of engineers is some means of physical exertion. The 1953 varsity football squad claims eleven engineers, headed by Captain Bill George of the Mechanical Engineering school.

Two regular starters on this year's basketball team are engineers — sophomore Ray Zelek, ChemE, and Wendy MacPhee, ME. ME's Poe Fratt and Richard Lewis engage in both varsity football and track. Other intercollegiate and intramural teams have a large representation from the engineering school.

Engineers are often elected as officers in student governing organizations. Jan Button, an Engineering Physics student, served last year as president of the Women's Self Government Association. This year, Skip Byron, also an EP, is the Senior Men's Council President. Last year's Student Council president, ME Gordon Lankton, served as a United States representative to a world conference on student government held in Japan this past summer. Other engineers hold positions on class councils, student council, as dormitory counselors, and on committees of these organizations.

Many engineers participate in musical organizations. Although personal recognition does not usually come to the members of these organizations, personal enjoyment does. The Big Red Band, Men's Glee Club, University Orchestra, and Sage Chapel Choir are the most popular of the music groups.

On the social side of an engineer's life, fraternities and the student union, Willard Straight, offer a chance both to enjoy yourself and to work on the committees that run these organizations. The religious groups, either working through Anabel Taylor or the separate churches, also offer a social program to their members besides the primary fuction of teaching about the church.

On the professional side of the engineer's life are the national or local honor societies, the student chapters of the professional societies, and local school societies.

Actually, only a few of the activities on this campus have been mentioned. On the journalistic side are the "*Sun*," the daily newspaper, and the "*Cornellian*," the yearbook, in addition to the ENGINEER. There are entertainment groups, such as the Dramatic Club, the Savoyards, the various variety clubs. There is the student radio station, WVBR. And there are many more.

In the following pages the ENGINEER staff has compiled a review in pictures of activities at Cornell—all of which are open to Engineers.

● For many years K&E has pioneered in the manufacture and development of finest quality surveying instruments. K&E surveying instruments are renowned all over the world for their superb performance under conditions of all kinds, for their magnificent workmanship and for special features that come of progressive ingenuity.

KEUFFEL & ESSER CO.

EST. 1867

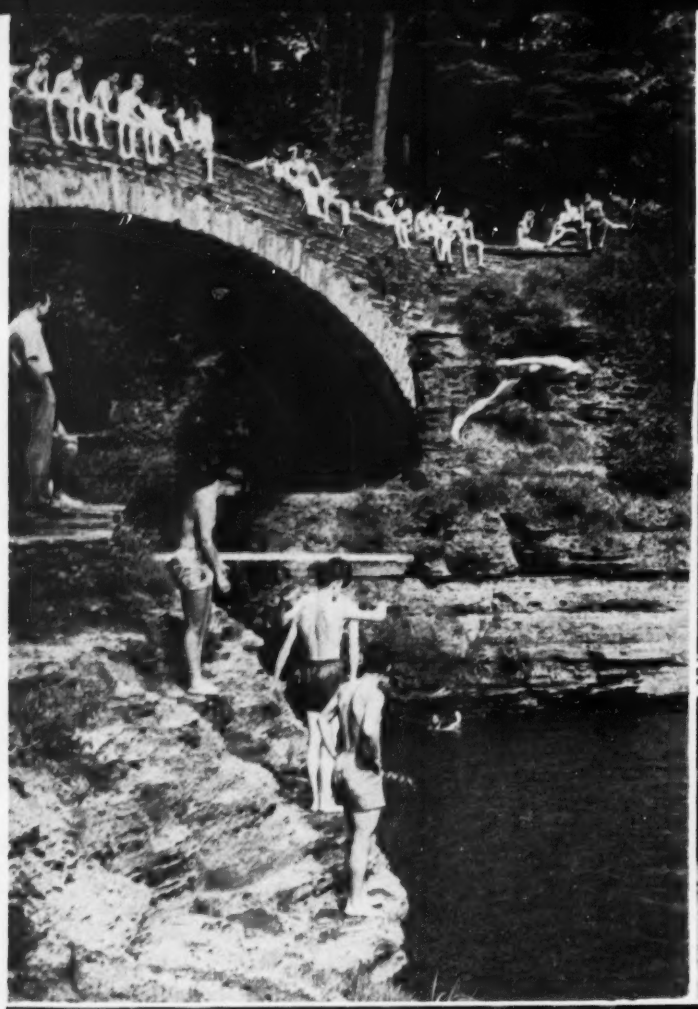
NEW YORK • HOBOKEN, N. J.

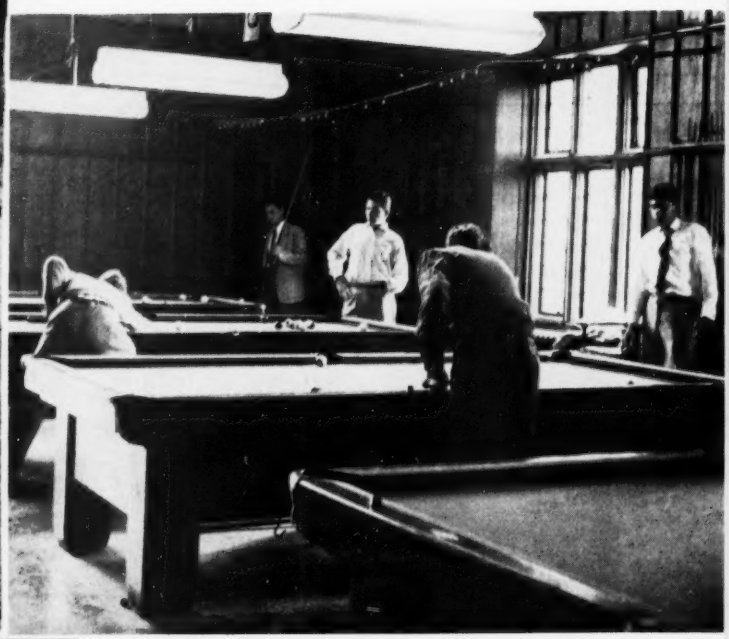
Chicago • St. Louis • Detroit • San Francisco • Los Angeles • Montreal

K+E

Drafting, Reproduction and Surveying Equipment and Materials, Slide Rules, Measuring Tapes.

It's Not A





It's Cold In Them Thar Hills!

All Work

Photos by Stuckelman, Zelin, Cohen

Big Man On Campus.

Col. 1 *top*: Swimming in Beebe Lake.

middle: The "Ivy Room" in Willard Straight Hall is a favorite place to spend an hour or two between classes. Students gather to talk, to eat, to play cards, to read their papers, to be sociable.

bottom: During Spring Weekend students make and race crude imaginative boats in the annual Beebe Lake crew race.

Col. 2 top: Students gather in Willard Straight Hall's game room for pool, billiards, ping pong, cards, chess.

bottom: Big name bands entertain couples at the Barton Hall Dance during the party Weekends.

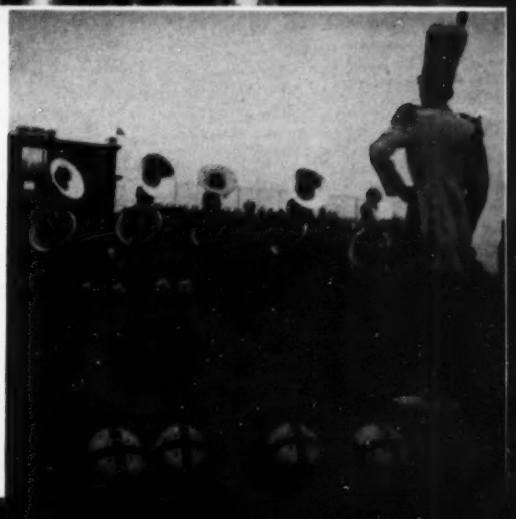
Col. 3 At Christmastime students gather on the steps of one of the buildings on campus to sing Christmas carols. This gathering is completely informal; all who come can participate .

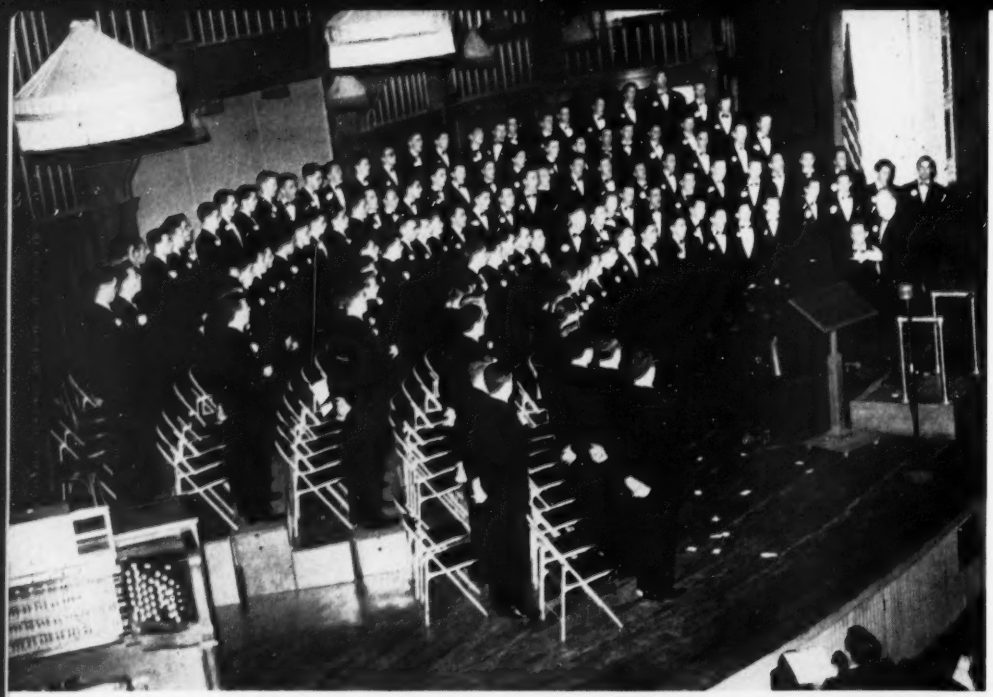
Col. 4 *top*: Small groups get together to participate in talent shows.

2nd: Large groups present complete shows in Bailey Hall.

3rd: Students get togther to sing, drink, and make merry.

4th: The Big Red Band performs.





Left: The Cornell Men's Glee Club serenades a capacity crowd of two thousand three hundred in Bailey Hall during one of its houseparty shows. Spring vacation every year sees the club touring part of the country; this year it will travel to Atlanta, Houston, Mexico City, Tulsa, San Francisco, and Los Angeles. Founded in 1880, the Glee Club is composed of seventy-two voices and is directed by Thomas B. Tracy, M.E., of the class of 1931.

—*Stuckelman*

below: *The Cornell Daily Sun*, a newspaper edited and managed exclusively by students, will celebrate its 75th anniversary next year. The third oldest college daily in existence, *The Sun* has the distinction of being the first student newspaper to join the Associated Press.

The Sun differs from most college papers in that it is a separate corporation chartered under the laws of New York State and existing wholly apart from University control. The only connection between the University and *The Sun* is that students attending the former work on the latter.

This year *The Sun* was judged the outstanding student newspaper in the country as far as news writing and editorial writing are concerned by Sigma Delta Chi, national professional journalism fraternity.

The Sun "rises" every morning in time for students to take it to breakfast and morning classes. It contains complete coverage of all important events on campus, complete sports news, women's news, editorial opinion, crossword puzzle, comic strips, and a summary of the major national and international news of the day. To accomplish this feat, a staff starts work at three the preceding afternoon and follows operations through to 2 a.m. the morning of publication.

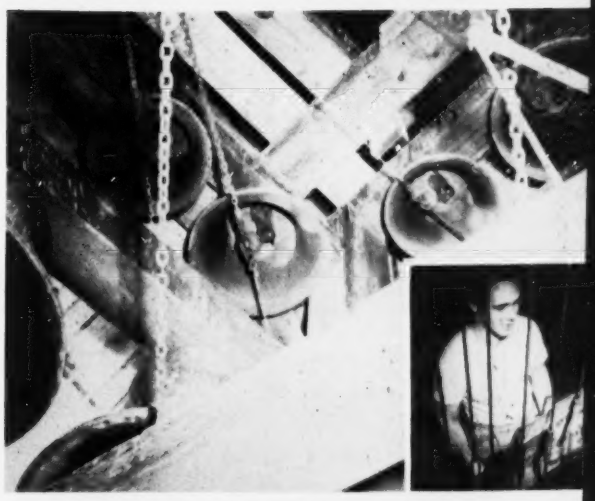
—*Cohen*

above: "This is WVBR, the voice of the Big Red, 640 on your dial." This is WVBR, Cornell's student owned and operated radio station, member of the Ivy Network, subsidiary of the Cornell Radio Guild, Inc. WVBR is a student station, transmitting programs aimed at students, at times when students can listen to them, currently over five strategically located transmitters. Besides its regular programs, WVBR also broadcasts major home sports events and all away basketball games. WVBR is run by students, who do all the announcing, engineering, programming, writing, and the other routine and special jobs required at a radio station.

—*Zelin*

right. Each morning at ten minutes to eight, Cornell's eighteen bells start the day with the playing of the "Jenny McGraw Rag"; they ring out again at ten to one and close the day with a serenade at six o'clock, ending each time with the traditional "Evening Song." They also herald athletic victories, play on special occasions, and chime the time of day. The bells, for those who wish to visit them, are 162 steps up in the Library Tower. They are mechanically operated from below by student chimesmasters.

—*Zelin*



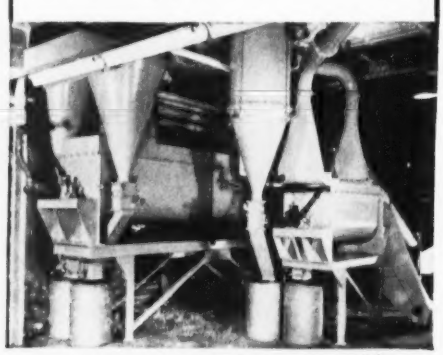
below. Since 1909, when it was organized, the Cornell Dramatic Club has been presenting shows for the Cornell audience. These shows range from comedies and tragedies, to musicals and Gilbert and Sullivan operettas. Eight shows are on the schedule for this year, each show being presented several times. Although having student casts, these shows are by major playwrights, as the play in production as this is being written, "Christopher Fry's "The Lady's Not For Burning". The scene pictured below, as you may already have guessed, is from Shakespeare's "Romeo and Juliet".

—*Cornell Daily Sun*

Another example of opportunities for engineers at LINK-BELT

Baby cream or volatile solvents--LINK-BELT helps make chemical processing more efficient

On this Link-Belt universal crescent flat top conveyor chain, jars of baby cream take this irregular path, each always riding separately on its own chain top plate.



Volatile solvents are efficiently recovered by a Monotube Dryer, one of many Link-Belt products widely used in chemical processing industry.

One source . . . one responsibility for conveying and power transmission machinery

The mammoth chemical industry moves and processes millions of tons of materials with LINK-BELT equipment

IN almost every phase of the huge chemical industry, you'll find Link-Belt conveying, processing and power transmission machinery at work. Likewise at quarries, mines and farms . . . in refineries, mills and factories—Link-Belt equipment handles materials every step of the way. This efficient equipment provides the high-capacity, trouble-free operation that brings more goods to more people at a lower price.

Hundreds of Link-Belt products serve all industry. And many engineers are needed to staff the laboratories, plants, engineering and sales offices of this nationwide organization. For facts on how you can become one of them, write for fully illustrated booklet, "An Introduction to Link-Belt." Or, if you're in the vicinity, stop in at one of the plants listed below. 13.377

LINK-BELT

LINK-BELT COMPANY

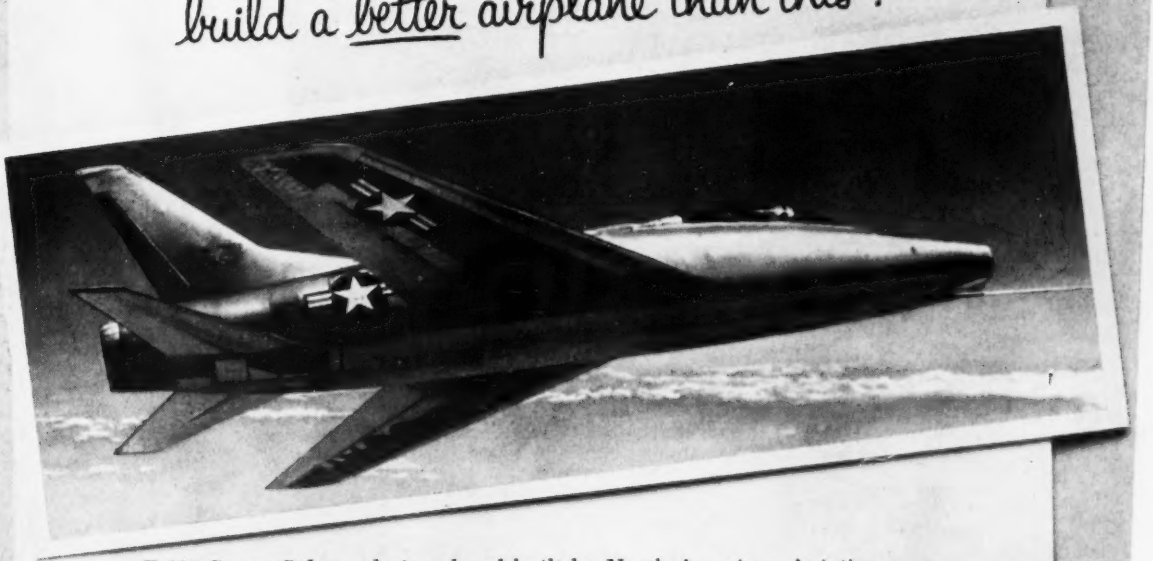
Executive Offices:
307 N. Michigan Ave., Chicago 1, Ill.

Atlanta . . . . . 1116 Murphy Ave., S. W.
Cedar Rapids, Iowa . . 1201 Sixth St., S. W.
Chicago 9 . . . . . 300 W. Pershing Road
Chicago 8 . . . . . 2410 West 18th St.
Colmar, Pennsylvania . . . . . 3400 Walnut
Houston 1 . . . . . 3203 So. Wayside
Indianapolis 6 . . . . . 220 S. Belmont Ave.
Indianapolis 6 . . . . . 519 N. Holmes Ave.
Los Angeles 33 . . . . . 361 S. Anderson Ave.
Minneapolis 5 . . . . . 200 Lyndale Ave., N.
Philadelphia 40 . . . . . 2045 W. Hunting Park Ave.
San Francisco 24 . . . . . 400 Paul Ave.
Seattle 4 . . . . . 3405 Sixth Ave., S.

NORTH AMERICAN HAS BUILT MORE AIRPLANES THAN ANY OTHER COMPANY IN THE WORLD

your challenge...

build a better airplane than this!



F-100 Super Sabre – designed and built by North American Aviation. America's first *true* tri-sonic fighter . . . flies faster than sound in level, operational flight. Now in priority production for the Air Force.

The plane *you* help design and develop will probably carry a designation somewhere in the mid-hundreds . . . perhaps it will be jet-powered, maybe ram-jet . . . or we will have developed a rocket propulsion system capable of sending it into the high Mach numbers. It may carry a pilot . . . it may not. But it will embody design principles, new electronic components and air artillery far advanced beyond anything now in the air.

North American Aviation, designers and builders of the world-famous F-86 *Sabre* Jet and the new ***F-100 Super Sabre***, needs engineers with vision and imagination . . . men with a solid technical foundation who will be ready to help design and build the better aircraft of tomorrow. Other fascinating careers are also open in North American's guided missile, jet, rocket, electronic and atomic energy programs. Projects that are years ahead to keep America's security strong.

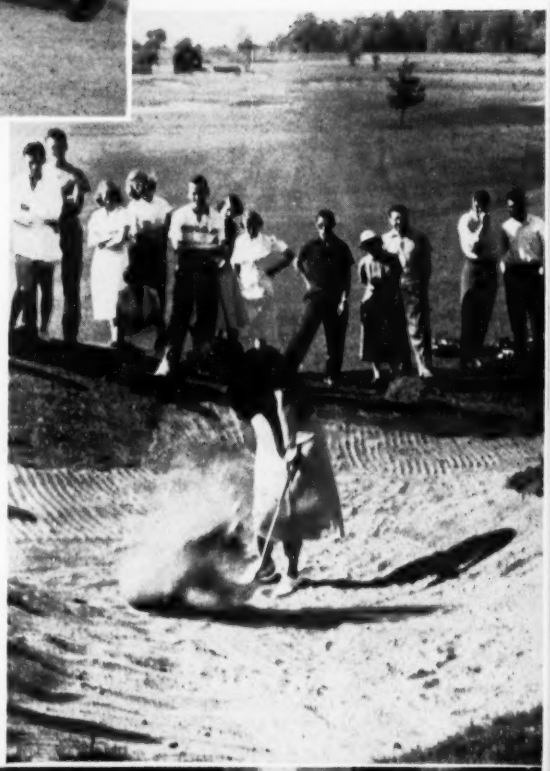
When you are prepared to enter the engineering profession, consider the well-paid career opportunities at North American. Meanwhile, write for information concerning your future in the aircraft industry.

Contact: **Your College placement office or write: *Employment Director,***

5701 West Imperial Highway Los Angeles	**12214 South Lakewood Blvd. Downey, Calif.**	**North American Aviation, Inc. Columbus 6, Ohio**

organization, facilities and experience keep **North American Aviation** *years ahead in aircraft . . . guided missiles . . . electronics . . . atomic energy . . . research and development*

You C
Also L



above: to fly. The Cornell Pilots Club is open to those interested in flying Its base of operations is Municipal Airport, where it rents light aircraft and maintains them. The Club provides all the essentials to flying and trains its own members, both new and old.

—Cohen

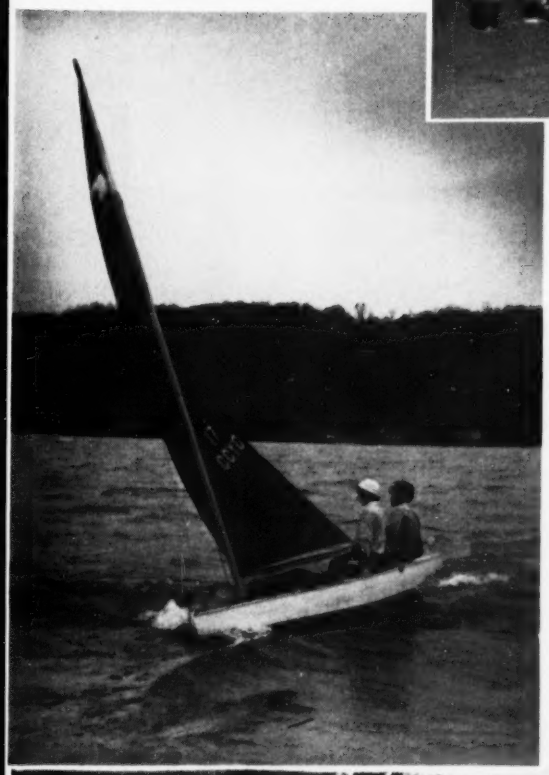
right: to play golf. Cornell has an eighteen hole golf course on campus that is open to all. Golf clubs, equipment, and lockers can be rented and golf instruction is available. There is a golf team for those who are really proficient in the sport.

—Cohen

below: to fire. The Cornell Rifle and Pistol Club is open to all students whether or not they have ever handled a gun before. They have the use of a fifty foot small bore indoor range and a 100 yard outdoor range. For those not owning their own weapons, 22 calibre rifles and pistols are available. The more serious marksman can earn a position on the pistol team or one of the six rifle teams that fire against other schools across the country.

—Cohen

Can Learn



above: to ride. Those who like to ride horses or who wish to learn to ride horses can do so at the riding hall, where, besides instruction, horse shows sponsored by the Saddle Club and Polo Games take place. Instruction in equitation and jumping is given in three grades, basic, intermediate, and advanced. About thirty horses are available for riding either in the indoor riding hall or on one of Cornell's outdoor riding trails.

—*Cohen*

left: to sail. Cornell is far above Cayuga's Waters, and down upon these waters can often be seen members of the Cornell Corinthian Yacht Club, perhaps racing, perhaps just taking things easy in a sailboat. The club is open to all students, who must prove their ability at handling a boat before they may take one out. Old members train new hands until the latter can sail with the best and can go on to train still newer members. The club owns and maintains its sailboats, a motor launch, and a boathouse.

—*Cornell Daily Sun*

below: to ski. Cornell offers several opportunities for skiers; there are several slopes on campus for the casual skier, and there is Tar Young Hill and its ski tow just a few miles off campus. When snow covers the ground the Cornell Ski School swings into operation, offering instruction to those who have never before been on skis, and to those who are past the beginners stage.

—*Cohen*

[R] LAVA

Manufacturers of Super-Refractories Only

◇

REFRACTORY CRUCIBLES
GRAPHITE CRUCIBLES
HIGH-TEMPERATURE CEMENTS
SPECIAL REFRACTORY BRICK, TILE, SHAPES

◇

From the Following Materials:—

GRAPHITE **SILICON CARBIDE** —— **FUSED ALUMINA** —— **MULLITE**
MAGNESIA **ZIRCON**

◇

LAVA CRUCIBLE-REFRACTORIES CO.
PITTSBURGH, PA.

For Superior Valves Specify FRICK

Whether for handling ammonia, Freon, or other gases and liquids at high pressures, you'll find Frick valves and fittings most dependable: a century of engineering experience is built into them. Sizes 1/4" through 14", with or without seal-caps; stocks in principal cities everywhere. Get the whole story on this superior equipment: write for literature.

The Frick Graduate Training Course in Refrigeration and Air Conditioning, operated over 30 years, offers a career in a growing industry.

DEPENDABLE REFRIGERATION SINCE 1882
FRICK CO.
WAYNESBORO, PENNA. U.S.A.

Headquarters
For all
ENGINEERS
at the
TRIANGLE BOOK SHOP

Scales—Slide Rules
T-Squares—Dwg. Boards
Tracing & Graph Paper
Everything for the Engineer by such famous manufacturers as Dietzgen, Keuffel & Esser, Pickett & Eckel, Post and others.

TRIANGLE BOOK CO-OP

Evan J. Morris, Proprietor
412 College Avenue Sheldon Court
Store Hours: 8:15 A.M. to 8:00 P.M.

A MESSAGE TO
COLLEGE ENGINEERING
STUDENTS

from J. M. Wallace, Manager, Meter Div.,
Westinghouse Electric Corporation
University of Pittsburgh, 1935

To the man who wants more than a job

You and I know that getting a job is not a problem these days. Industry needs thousands of young engineers.

But the man who wants more than a job might well pause and consider just how he is going to find his special opportunity. It cannot be found everywhere.

The man I'm talking about wants interesting work with a future, yes—but also something more. He is determined to help make the world a better place in which to live—and wants a job that will enable him to do this. He is co-operative in his work, but demands the dignity of being treated as an individual. This man had high purpose when he elected a career as an engineer.

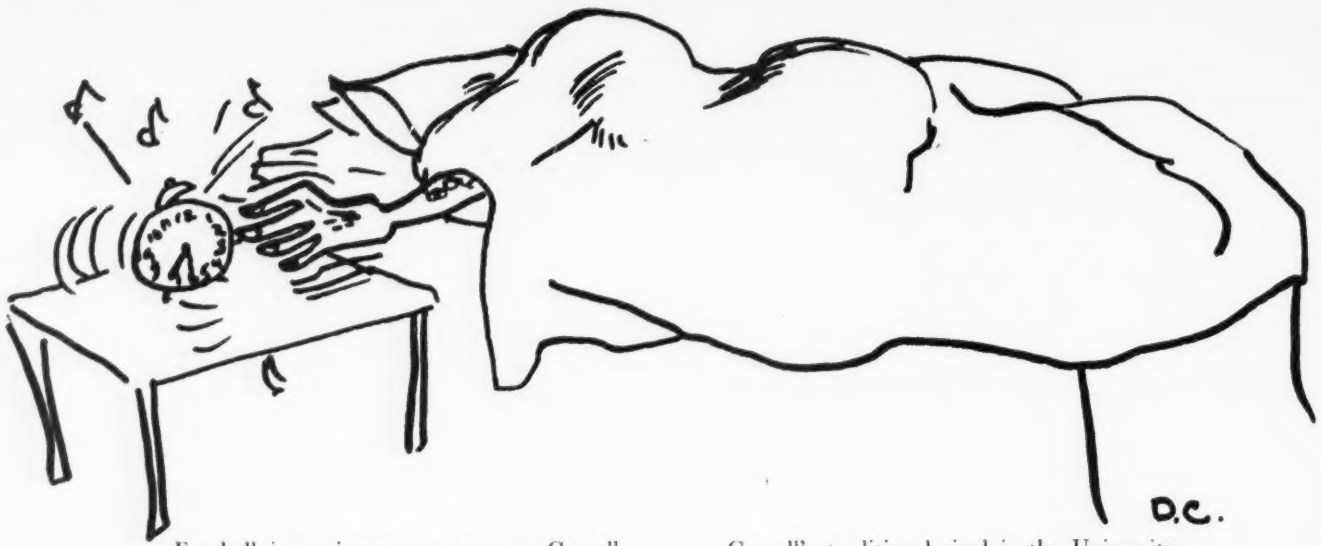
I know this man. He's many men at Westinghouse. He's an engineer's engineer.

You, who want more than a job, are this man, too. You will be among your own at Westinghouse. G-10273

YOU CAN BE SURE...IF IT'S
Westinghouse

For information on career opportunities with Westinghouse, consult Placement Officer of your University, or send for our 44-page book, *Finding Your Place in Industry.*

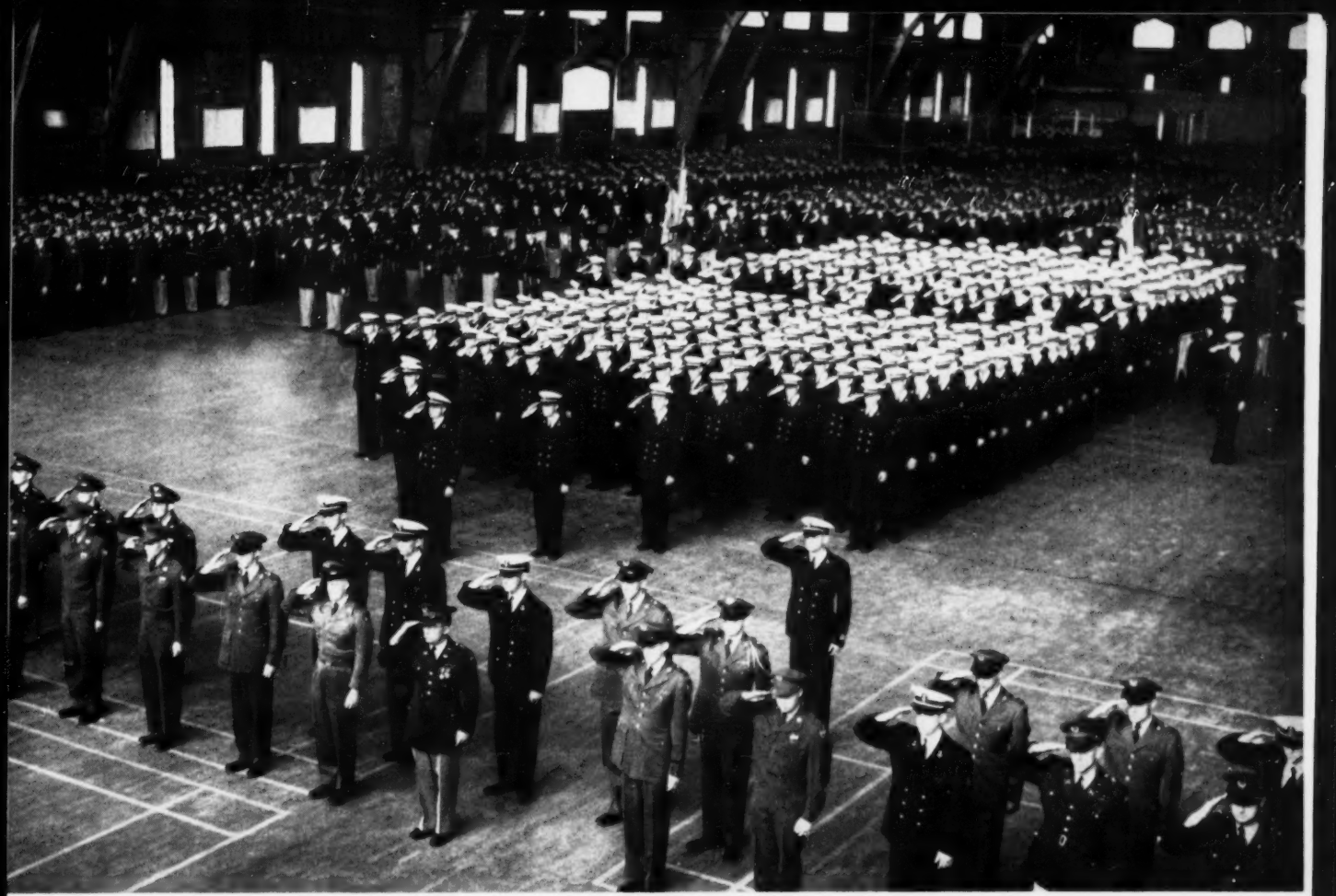
Write: Mr. P. B. Shiring, Regional Educational Co-ordinator, Westinghouse Electric Corporation, Ellicott Sq. Bldg., Buffalo 3, New York.



Football is an important sport at Cornell. As a member of the Ivy League, the team plays the major portion of its nine game schedule against other Ivy League schools, the remainder of the games being with various other major teams, this year Colgate, Rice, Navy, and Syracuse.

Cornell's traditional rival is the University of Pennsylvania, in a game played each year on Thanksgiving Day. Last season Cornell had a 4-3-2 record and led the Ivy League with a 3-0-2 record against League teams.

—*Zelin*



Currently, Military Training is a required course for all physically fit freshmen and sophomores who are citizens of the United States. Those who complete the optional advanced course of two years are commissioned Reserve Officers. At Cornell, there are three branches of the Reserve Officers Training Corps, more commonly known as the ROTC, which are Military Science and Tactics, Air Science and Tactics, and Naval Science.

In the pictured ROTC review, approximately 4000 cadets, representing all three branches, took part. Because of poor weather it was held indoors on the almost two acre main floor of Barton Hall.

—Cohen

Two years of Physical Training is normally required for graduation. The student attends the class three times a week and may do calisthenics, gymnastics, or participate in some sport like football or soccer in the fall and basketball or badminton during cold or poor weather. He may also fulfill his P.T. requirement with a varsity or intramural sport, on the golf course, at the bowling alleys, on the rifle range, or in the swimming pool. Indoor classes are held in Barton Hall and the Old Armory.

—Cohen

NEWS OF THE COLLEGE

Selection of Cortland as the subject for a two-year Cornell study in city planning and municipal administration was announced jointly by Mayor Robert Kerr and the University.

"Exercise Cortland" will be carried out by groups of graduate students from the School of Business and Public Administration and the Department of City Planning in the College of Architecture. The project will result in the preparation of a general report of municipal activities, a "master plan" to guide long-range physical development of the city, and a "capital budget" of proposed public works for the following six years.

Supervisors for the project are Prof. A. M. Hillhouse, a leading authority in the field of municipal finance, and Prof. John W. Reps, former head of planning for Broome County.

The Cortland project marks a departure from Cornell city planning studies carried out in recent years in Auburn, Elmira, Geneva, Rome, Binghamton, and other communities, in that the School of Business and Public Administration is participating for the first time.

Students in Professor Hillhouse's class in Municipal Administration will undertake the first phase of the Cortland project. This group will analyze current practices in city government and present the findings in the form of an "annual report."

Next fall city planning students from the College of Architecture will prepare a complete plan for physical development of the city, including recommendations for parks, streets, schools, traffic control, industrial sites, bus routes, and utility services. Zoning, subdivision control and the function of an official Planning Board in carrying out the plan will also be considered.

The third and final phase of the study will be undertaken in the spring of 1955 by another group of students in the School of Business and Public Administration. They will prepare a capital budget, based on the master plan, which will offer an orderly schedule of public works to be carried out over a period of years.

Lebanese American Federation Cites Professor Malti

Dr. Michel G. Malti, professor of electrical engineering at Cornell, has been cited by the Syrian and Lebanese American Federation for his contributions to science.

Michel G. Malti

Among the guests were government and United Nations officials from this country and the Middle East, including the ambassadors of Iraq, Egypt, Syria, and Saudi-Arabia, Syria's chief delegate to the UN, and Major Jimmy Jibara, the first American jet ace pilot.

Professor Malti was born in Lebanon and became a United States citizen in 1926. He holds degrees from the American University of Beirut, the Georgia School of Technology and Cornell. He has taught at Cornell since 1923.

Among Professor Malti's writings are "Electric Circuit Analysis," "Heaviside's Operational Analysis," two sections of O'Rourke's "General Engineering Handbook" and many articles reporting original researches and discoveries. He is editor of the Wiley series of electrical engineering textbooks.

Professor Malti has been a consultant with Elliott Company, the U.S. Navy, and General Electric Company. He belongs to numerous professional and honorary societies. He has been chairman of the American Institute of Electrical Engineers' committee on basic sciences and is currently chariman of its subcommittee on applied mathematics.

Atomic Energy Lecture

A talk on "Atomic Power—Present and Future" was given by L. W. Niedrach of General Electric's Knolls Atomic Power Laboratory in Schenectady on December 3.

The talk was sponsored by the Cornell section of the American Chemical Society and was open to the public.

Professor Fay Attends NATO Symposium

Prof. James A. Fay of the College of Engineering at Cornell attended a symposium on combustion problems which met in Cambridge, England, from Dec. 4-11.

The symposium was sponsored by AGARD (Advisory Group for Aeronautical Research and Development), a NATO agency of which Dr. Theodore von Karman is chairman.

Fellowship in Pavement Studies Announced

The School of Civil Engineering has announced the establishment of a two-year fellowship for graduate study in the use of bituminous materials and aggregates for bituminous paving mixtures.

This fellowship has been made possible by the generosity of the New York State Bituminous Concrete Producers Association.

The announcement noted that opportunities for study and research in the bituminous paving field at Cornell are enhanced by the availability of a small but well-equipped bituminous laboratory and excellent library facilities.

Information about the fellowship may be obtained from Professor Taylor D. Lewis, Lincoln Hall, Cornell University.

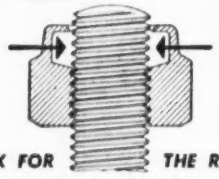
Cornell United Religious Work

—Cohen

Long an important force in campus life, the CURW is now the proud occupant of one of Cornell's most impressive new buildings, Anabel Taylor Hall. Here worship services are conducted for all faiths, meetings are held for the many religious groups on campus, and offices are maintained for clergymen serving Cornell. Special activities sponsored by CURW are Freshman Camp, an event for entering students held every fall prior to the opening of school, and the annual Campus Conference on Religion, featuring three days of symposiums and discussion groups which reach the entire campus.

—Cornell Daily Sun

Whenever fastening problems arise...



LOOK FOR THE RED LOCKING COLLAR

It is threadless and resilient. Every bolt impresses (but does not cut) its full thread contact in the Red Elastic Collar to fully grip the bolt threads. In addition, this threading action properly seats the metal threads—and eliminates axial play between bolt and nut threads. All Elastic Stop Nuts—regardless of type or size—lock in position anywhere on a bolt or stud, maintain accurate adjustments and seal against liquid seepage. Vibration, impact or stress reversal does not disturb prestressed or positioned settings.

Consider ELASTIC STOP NUTS

Whenever fastening presents a problem—ESNA is ready with a quick answer. More than 3000 types and sizes of self-locking vibration-proof fasteners—plus the "know-how" of ESNA engineers—are available here at ESNA.

ESNA has long been known as "design headquarters" for self-locking fasteners. Accepted by Army, Navy and Air Force, virtually every aircraft built in the past decade has been Elastic Stop Nut-equipped. On the railroads, in the oil fields, on automobiles and construction equipment, Elastic Stop Nuts manufactured to exacting quality control standards, are doing specialized jobs every day.

Be familiar with the design help ESNA offers. Write us for details on Elastic Stop Nuts. Elastic Stop Nut Corporation of America, 2330 Vauxhall Road, Union, N. J.

ESNA

ELASTIC STOP NUT CORPORATION OF AMERICA

DESIGN HEADQUARTERS FOR SELF-LOCKING FASTENERS

BEYOND THE HORIZON....

Higher and higher the speeds; greater and greater the stresses.

To match needs which are still beyond the horizon, the engineer is increasingly urging the metallurgist to supply new materials.

The more efficient engines of today rely upon the use of temperature-resisting molybdenum-containing alloys; the jet engines of the future, with still greater stresses and higher temperatures, must rely even more upon Molybdenum.

Climax furnishes authoritative engineering data on Molybdenum applications.

Climax Molybdenum Company

500 Fifth Avenue · New York City 36 · N.Y.

THE DU PONT DIGEST

Plant Development

Offers Training and Opportunity

John Purdom, M.S. in Ch.E., Ohio State '48 (*right*), confers with other engineers on the progress of a new plant.

A young chemical engineer recently had his first assignment in a *Plant Development* group at Du Pont. He was part of a team assigned to improve recovery of adipic acid, a nylon intermediate, from plant-waste streams.

First, he made a literature survey for possible leads. Three recovery methods came under consideration: *solvent extraction*, *crystallization*, and a combination *distillation-crystallization* process. He helped to set up a laboratory program to compare and evaluate them.

Preliminary results were somewhat inconclusive. It was decided to go ahead with semi-works tests, while an organic chemist completed the laboratory work.

Next, the young chemical engineer joined forces with a mechanical engineer to design a semi-works plant to evaluate each method. In this plant, all vital points were checked and rechecked: materials of construction, steam and water requirements, heat-transfer coefficients, yields, product quality, and pollution problems.

The semi-works data revealed that the *distillation-crystallization* process was the most economical, and also gave the best product quality. Usually, the next step would be construction and operation of a pilot plant. But this time, engineers from the *Production Division* arranged for a limited-scale plant test, using a spare batch still and a crystallizer on a part-time basis. Two months of testing confirmed the previous data—the new *distillation-crystallization* process recovered adipic acid efficiently, and would reduce costs considerably. The plant is now using this process successfully.

Robert Thomson (*left*), B.S. in Ch.E., Univ. of Va. '50, **David S. Rumsey** (*center*), M.S. in Ch., Univ. of Mich. '48, and **Rene M. LeClair** (*right*), M.S. in Ch. E., M.I.T. '51, test samples on an experimental batch unit.

That's how one young chemical engineer started his career in a typical Du Pont *Plant Development* group. The job of such groups is to make processes and equipment more efficient, to adapt products to new uses, and to improve product quality.

Plant Development work not only offers opportunity in itself but valuable training for other fields.

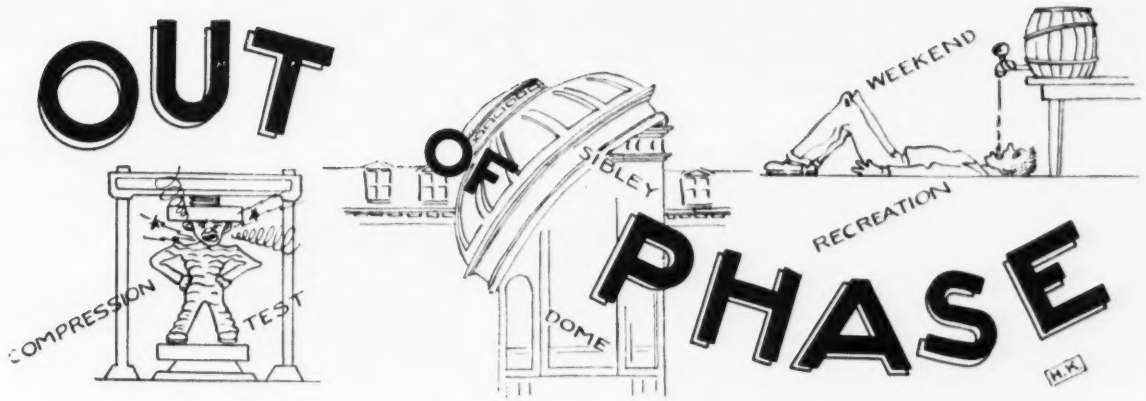
ASK FOR "Chemical Engineers at DuPont." This new illustrated booklet describes initial assignments, training, and paths of promotion. Just send a post card to E. I. du Pont de Nemours & Co. (Inc.), 2521 Nemours Building, Wilmington, Delaware. Also available: "Du Pont Company and the College Graduate" and "Mechanical Engineers at Du Pont."

DU PONT

REG. U.S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING
. . . THROUGH CHEMISTRY

Watch "Cavalcade of America," on Television



There have been times in the career of every Cornellian when he has quailed before the almighty "preliminary examination." Herewith we give an expert's comforting analysis of the situation.

I have noted with sadness that many engineers are going into prelims with the look on their faces that is usually seen on condemned convicts walking the last mile. This is indeed an unhealthy attitude.

A prelim *should* be a pleasant experience, an opportunity for the tired student to have a fairly private seat in a fairly quiet room away from the hustle and bustle of the other classes of the day.

The engineer should in all cases be able to fill one prelim book completely and accurately in ten minutes and spend the rest of the period on omphaloskosis. Yet, I am fully aware that most engineers have not reached this blissful state of relaxation during prelims.

Therefore, with a view towards decreasing the sale of Nodoze and increasing the marks of each and every engineer I intend to give here the long-hidden secret of success.

1. Contemplation of the Navel. An art well-known to the Greeks and various yogas. Introduced to Cornell by a math instructor of no mean ability by name of Holtzinger. On a diff equations prelim, after stating the problem, he added, "Solve by Undetermined Coeffcients or Omphaloskosis." At that time I was somewhat unskilled in the ancient art, and Undermined Coefficients did much more for the rest of the class than Omphaloskosis did for me.

Anyone who has taken Descriptive Geometry knows how well one can do on a prelim if the questions are given in advance. Given the questions, one can always dig up the answers.

With no further fanfare, I hereby give to the world and the fraternity files, prelim questions such as you may expect to receive on your first prelim in . . .

Freshman English:

(A) Write a ten-thousand word explanation of this sentence — "Stepped in what?"

(B) How old was Chaucer's mother when she was born?

Calculus 161:

Part 1: Evaluate the following indefinite integral in terms of elementary functions:

(a to the X^2 power) dx

Part 2: Find the work done in the work done by a three-legged man lifting a pot of rabbit stew from the kitchen stove to the star Betelguese. Show all work.

Heat-Power or EP 8121:

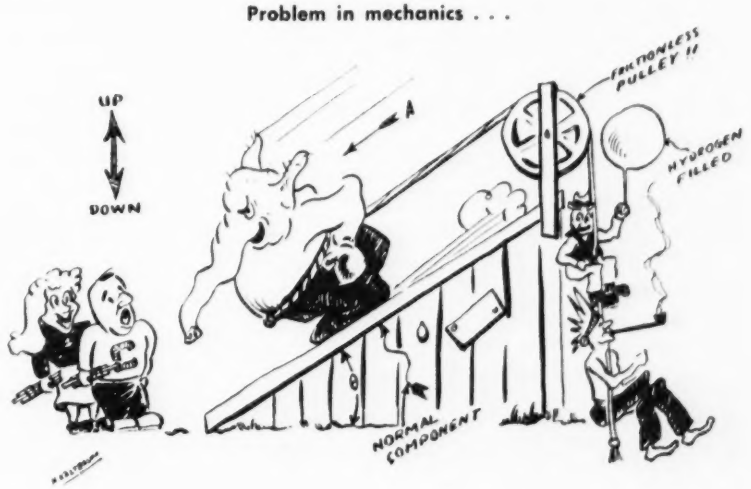
Design a complete power plant to take in coal from Scranton at 4 p.m. daily, and to supply nine billion megawatts. Assume standard temperature and pressure. Compute: pressure ratios, temperatures, materials required, number of men employed in construction and operating power plant, number of molecules in a mole, ratio of this enthalpy to that enthalpy, and everything else you would compute if you knew as much as the professor.

Mechanics:

Assume that an elephant, color pink, mass 22,000 kilograms, is sliding down an inclined plane. The coefficient of sliding friction, as

(*Continued on page* 51)

Problem in mechanics . . .



1943
AN AWARD
Carbide and Carbon Chemicals Corporation
1946
AN AWARD
Union Carbide & Carbon Corporation
1933
AN AWARD FOR CHEMICAL ENGINEERING ACHIEVEMENT TO CARBIDE & CARBON CHEMICALS CORPORATION
PRESENTED BY CHEMICAL & METALLURGICAL ENGINEERING
1953
AN AWARD FOR CHEMICAL ENGINEERING ACHIEVEMENT TO CARBIDE & CARBON CHEMICALS COMPANY
PRESENTED BY CHEMICAL ENGINEERING

Awards that foretell your gain

Chemicals from coal hydrogenation...

...acclaimed the 1953 Chemical Engineering Achievement!

IN 1933 Carbide received the first Chemical Engineering Achievement Award. This recognized the beginning of commercial production of much-needed chemicals from petroleum and natural gas—which proved to be the beginning of the American petrochemical industry.

HISTORY REPEATS—Now, just twenty years later, Carbide has received the 1953 Chemical Engineering Achievement Award for "the first successful production of chemicals from coal by a high pressure hydrogenation process."

In minutes, coal becomes gases and liquids rich in needed chemicals—"one of the major contributions in this century to the well-being of us all."

Some of these chemicals are used in making plastics, synthetic rubber, pharmaceuticals, vitamins, and many other things. Others are completely new and hold great promise.

FOURTH RECOGNITION—Carbide is the first two-time individual recipient of this award. It also is the fourth time the people of Carbide have been recognized, for they shared in two previous group awards—in 1943 for synthetic rubber, and in 1946 for atomic energy.

TRUE SIGNIFICANCE—As in all Chemical Engineering Achievement Awards, coal hydrogenation was recognized not as the accomplishment of any one individual but as the result of the cooperative efforts of many.

The people of Union Carbide appreciate the recognition of their achievement by the distinguished Committee of Award, composed of senior chemical engineering educators.

UNION CARBIDE
AND CARBON CORPORATION
30 EAST 42ND STREET UCC NEW YORK 17, N. Y.

UCC's Trade-marked Products include

SYNTHETIC ORGANIC CHEMICALS
EVEREADY Flashlights and Batteries
BAKELITE, VINYLITE, and KRENE Plastics
ELECTROMET Alloys and Metals
PYROFAX Gas
HAYNES STELLITE Alloys
DYNEL Textile Fibers
PRESTONE Anti-Freeze
UNION Carbide
PREST-O-LITE Acetylene
LINDE Oxygen
NATIONAL Carbons
ACHESON Electrodes

determined experimentally by rolling soft-boiled eggs down the plane, is 0.4. There is a south south-west wind blowing at a velocity of 8 mph. The effective frontal area of the pachyderm is 19 square feet. A rope is attached to the elephant. This rope is passed over a pulley. The resisting torque of the pulley is 2 dyne-ft.

At the other end of the rope are three climbing men, two midgets and one nearsighted Cherokee. The midgets' names are George and John, while the Cherokee is named Henry Splash-in-the-vacuum-tube. All three are climbing upwards at the rate of 25 cm/year. The elephant slides down-hill with uniform velocity.

Two lady engineers standing at the bottom of the inclined plane have a combined weight of 335 pounds. Assuming that entropy is always changing, is the elephant sliding downhill head or tail first?

Chemistry 105:

(A) Give complete details of laboratory preparation of the Philosopher's Stone.

(B) List all the formulas that you have been able to memorize up to the present time.

(C) Reproduce exactly, from memory, the twenty-four columns of the tables of heats of combustion appearing on page 1189 of the *Handbook of Chemistry and Physics.*

History 101:

1. What was exact minute of what hour of what day that General Lee said to his batman, in speaking of General Grant, "That damn yankee!" Give a 200 page dissertation on the political, economic, mathematical and personal events and disturbances leading up to the utterance of this obscure statement.

2. On page 44 your three hundred page reading assignment for last week, a certain twelve letter word was used to describe the facial expression of one of the members of the ninety-fourth coalition cabinet formed by the King of Tanna-Touva during the three weeks, rebellion of spring, 874 BC. What was that word?

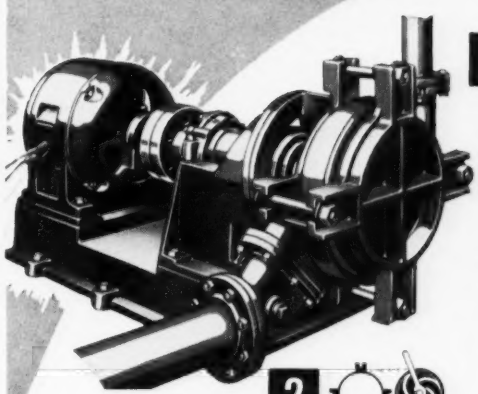
—Herbert Spirer, B.E.P. '51

Morris

Type R Slurry Pump

Gives Longer Service, Less Trouble

because



1

No internal studs or bolts — no troublesome internal joints and fits. Suction Disc Liner is merely *clamped* into position between disc and shell. Fewer wearing parts mean less maintenance and longer uninterrupted service.

2

Impeller and shaft sleeve of the Morris Type-R Slurry Pump can be renewed *without disturbing* the suction and discharge piping or the bearings. This means considerably less lay-up time.

3

Due to the clamping effect of the bolts on the discs, the shell is not subject to high stress. Consequently, the shell can be made of a wide variety of materials, including those of high abrasive resistance. Yet these materials need not necessarily be of high tensile strength.

4

Hydraulic passages of the suction discs are extremely large and velocities are low. As a result, wear is minimized and renewal infrequent.

5

Stuffing box troubles are practically eliminated because the suction gland is under low suction pressure only.

Write today for free bulletin

Practical information in Bulletin No. 181 shows by performance curves just how the Morris Type-R Slurry Pump fits specific operations . . . describes exclusive construction features that cut operating costs.

FOR CHEMICAL OPERATIONS

Morris Type-R Slurry Pump handles mixtures containing ore concentrates . . . tailings, slag and residue from filters and classifiers . . . all types of caustic or acid mixtures containing abrasives or solids.

MORRIS MACHINE WORKS

Baldwinsville, N. Y.

Branch Offices in Principal Cities

MORRIS *Centrifugal Pumps*

● Wallace L. Carr was graduated from the University of Illinois with a B.S. degree in Electrical Engineering in 1951. After a short time with a large electric utility—where he was Junior Engineer in substation design—he came to Allison where he is presently Electrical Engineer in the plant engineering department, Aircraft Engine Operations.

Wally's job in this department varies from designing plant, lighting, and power layouts, and machinery electrical diagrams to electrical and instrumentation layouts of turbo-jet and prop-jet test cells. With a multimeter, he is shown above checking the thermocouple circuits on the control panel in one of the Allison test cells.

In jet cells, it is necessary to simulate all engine controls that appear in a jet plane, plus other controls which are necessary to check and evaluate engine performance . . . operating temperature . . . acceleration . . . speed . . . fuel consumption . . . oil flow, etc.

Electronic control of important functions of jet engine operation has made the electrical portion of test cell operation a complex and fascinating problem for the Electrical Engineer.

Allison, a leader in the field of turbine engines, offers unlimited opportunities to young graduates with degrees in Mechanical Engineering, Electrical Engineering, Aeronautical Engineering and Industrial Engineering. Why not plan early for *your* engineering career at Allison.

For further information about YOUR engineering career at ALLISON, discuss it with your Placement Counselor and arrange for an early interview with the ALLISON representative the next time he visits your campus. Or, write now for further information: R. G. Greenwood, Engineering College Contact, Allison Division, General Motors Corporation, Indianapolis 6, Indiana.

Allison **DIVISION GENERAL MOTORS CORPORATION • Indianapolis, Ind.**

Design, development and production—high power TURBINE ENGINES for modern aircraft . . . heavy duty TRANSMISSIONS for Ordnance and Commercial vehicles . . . DIESEL LOCOMOTIVE PARTS . . . PRECISION BEARINGS for aircraft, Diesel locomotives and special application.

CORNELL SOCIETY OF ENGINEERS

107 EAST 48TH STREET 1953-54 NEW YORK 17, N.Y.

THOMAS W. HOPPER, M.E. '28, *President* .....1700 Sansom St., Phila. 3, Pa.

WALTER M. BACON, E.E. '30 .....*Executive Vice-President*
510 East 84th St., New York 28, N. Y.

WALTER L. HARDY, Ch.E. '38 .....*Secretary-Treasurer*
421 East 20th St., New York 10, N. Y.

WILLIAM M. LEONARD, M.E. '24 .....*Recording Secretary*
4 Irving Pl., New York 3, N. Y.

Delaware Valley Branch
FRANK L. O'BRIEN, JR., M.E. '31, *Vice-Pres.* ....1545 N. Delaware Ave. Phila. 25, Pa.

New England Branch
J. RUSSELL CLARKE, JR., M.E. '26, *Vice-Pres.* .....Westford Rd., Concord, Mass.

New Jersey Branch
JOHN WEIKART, Ch.E. '42, *Vice-Pres.* .....714 Woodland Ave., Westfield, N. J.

Chicago Branch
FREDERICK H. BIRD, M.E. '11, *Vice-Pres.* .....1077 Westmoor Rd., Winnetka, Ill.

Detroit Branch
PHILIP J. KENT, M.E. '14, *Vice-Pres.* .....P.O. Box 1118, Detroit 31, Mich.

St. Louis Branch
ARTHUR J. LEUSSLER, M.E. '23, *Vice-Pres.* .....30 Rio Vista Dr., Clayton 5, Mo.

Honorary President: S. C. Hollister, Dean of the College of Engineering

Honorary Vice Presidents:
C. R. Burrows, Director of the School of Electrical Engineering
N. A. Christensen, Director of the School of Civil Engineering
H. J. Loberg, Director of the Sibley School of Mechanical Engineering
F. H. Rhodes, Director of the School of Chemical and Metallurgical Engineering
W. R. Sears, Director of the Graduate School of Aeronautical Engineering
L. P. Smith, Director of the Department of Engineering Physics

Thomas W. Hopper

"The objects of this Society are to promote the welfare of the College of Engineering at Cornell University, its graduates and former students and to establish closer relationship between the college and the alumni."

The future of young engineers starting their careers in industry lies in one of two fields. In one direction is the field of expert proficiency. Here the engineer, over the years, acquires a special knowledge of a particular subject and a special technique for solving problems that permit him to excel as specialist or consultant in his field. Such a man gives professional service to his company and receives salary and recognition in due proportions.

In the other direction is the field of management, which has to do with the direction of engineering groups, operating departments, manufacturing, sales, and overall company policy. It is amazing how many companies are managed by officers who started their careers as engineers at the bottom of the ladder. It is also surprising how many graduate engineers are filling positions of a supervisory nature. The Engineers' Joint Council Survey of 1946 indicated that over 30 per cent of graduate engineers are in such positions.

The engineer is qualified through education and training to advance rapidly in either direction mentioned above. He has usually learned to be accurate, has acquired a working knowledge of mathematics and science, has developed the ability to solve all kinds of problems. Through working thousands of problems, from the first year of his college career, he has learned to assemble data to determine the basic rules involved and to apply properly the fundamentals to the problem at hand. This technique is commonly called the Engineering Approach and may be readily applied to the solution of business problems as well as problems of a technical nature. Coupled with special knowledge of the physical sciences and human relations, it will fit an engineer potentially for almost any kind of position in industry.

Practically every position in industry requires ability as a businessman. Many engineers are woefully weak in this respect. In my opinion many of the complaints on non-recognition and isolation by engineers stem from a lack of appreciation and of interest on their part for learning the business aspects of their employment. Engineers are engaged in business, by business, and for business. They are an important part of management no matter where in the line of staff they start and end their careers. Undoubtedly they would achieve much greater recognition, higher incomes, and more personal satisfaction if they recognized this fact at the start of their employment.

An engineer can be a businessman and also be a good professional engineer. The requirements of the two are compatible in every respect. The professional engineer is devoted to giving service to his company or client to the best of his ability, based on his highly developed training and education. He is also dedicated to raising the standards of his profession and to devoting time to the training of younger engineers. Finally, he is expected to give freely of his time and knowledge to the discussion and study of engineering matters affecting the safety and welfare of the public. These activities give recognition to the engineer as an individual and prestige to his profession as a group. They are definitely in line with the desires of industry as a business concern.

Uniformity gained by "Centrifugal Casting"

The great majority of cast iron pressure pipe produced today is cast centrifugally, in metal or sand-lined molds.

When this mechanized process was introduced 27 years ago, its potentialities for improved production controls were evident. For human fallibility was largely replaced by machine accuracy based on scientific principles.

The improved production controls made possible by the centrifugal casting process have long since been realized. Hundreds of millions of feet of centrifugally-cast-iron pressure pipe are now in service. All of this pipe is more uniform in metal structure, in wall thickness, and in concentricity, than pipe not centrifugally cast.

Better production control means better pipe; it results in greater uniformity of quality.

Production controls in cast iron pipe foundries start almost literally from the ground up with inspection, analysis and testing of raw materials; continue with constant control of cupola operation by metal analysis; and end with rigid tests of the finished product.

By metallurgical controls and tests of materials, our members are able to produce cast iron pipe with exact knowledge of the physical characteristics of the iron before it is poured into the mold of a centrifugal casting machine.

Cast iron pipe is the standard material for water and gas mains and is widely used in sewage works construction.

Send for booklet, "Facts About Cast Iron Pipe." Address Dept. C., Cast Iron Pipe Research Association, T. F. Wolfe, Engineer, 122 So. Michigan Avenue, Chicago, 3, Illinois.

Section of 114-year-old cast iron gas main still in service in Baltimore, Md.

CAST IRON PIPE SERVES FOR CENTURIES

ALUMNI ENGINEERS

Frank D. Newbury, M.E. 01, is Assistant Secretary of Defense in Applications Engineering, which he says "is Government English for product design." Retired in 1951 after forty-five years as vice-president of Westinghouse Electric Co., Newbury is one of the six new Assistant Secretaries appointed by Defense Secretary Charles E. Wilson under the Reorganization Act of last June 30. He lives in Washington at The Westchester, 4000 Cathedral Avenue, Washington, D.C. **Fortune** for November, reporting on the "Pentagon Secretariat," says that "Deputy Secretary Roger Kyes hopes that Newbury will be able to re-engineer 20 per cent of common military 'hardware' for production on standard tooling."

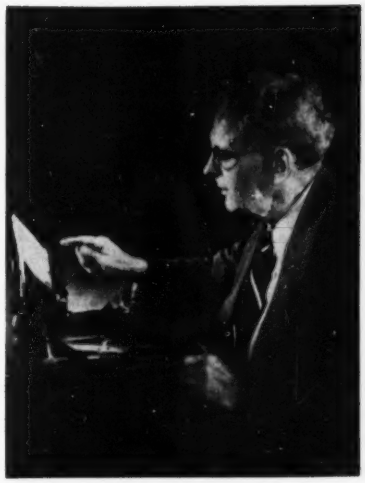
Walter Sturrock, E.E. '15, living at 15002 Terrace Road, E. Cleveland 12, Ohio, is illuminating engineer in charge of technical publications with the Lamp Division of General Electric at Nela Park, Cleveland. He has issued many papers on the technical engineering problems of lighting and is a past-president of Illuminating Engineering Society Council.

Robert B. Lea, M.E. '15, has been elected Director-at-large of the American Society of Mechanical Engineers. He notes "nobody blackballed me, so I was elected." Bob was with the Sperry Gyroscope Co. from 1915 to 1948, when he transferred to the Sperry Corporation. He served as special assistant to the president until 1949 when he was made Co-ordinator of Exports. Bob has been a life member of ASME since 1946.

Ngeu F. Tsang, E.E. '27, is visiting professor of electrical engineering at University of Arkansas in Fayetteville, this year.

Hannibal Choate Ford, M.E. '03, noted inventor and founder of the Ford Instrument Company of Long Island, has been featured in the **Sperryscope,** publication of the Sperry Instrument Company, and in the "Look Applauds" column of **Look Magazine** (October issue). A $4,000-a-year fellowship for study at Cornell was presented this year in Ford's honor by the Ford Instrument Company in recognition of his contributions to science.

Ford has invented devices of great military significance, many of them still top secret. The **Look** article describes him as "the genius



Hannibal C. Ford

behind the phenomenal 'mechanical brain' gun fire-control mechanisms aboard our naval vessels." He invented the first mechanical brain for computing naval gun fire, the first device to control anti-aircraft fire, the first automatic tracking bombsight, and the first automatic computing sight for machine guns. He was co-inventor with the late Elmer A. Sperry, A.M. '15, of the gyrocompass.

David Edward Donley, for three years associate professor of **Civil Engineering** and head of the Hydraulic Engineering Department at Cornell, has departed for Lebanon to join the technical cooperation mission of the Foreign Operations Administration. He will serve as hydrologist in plans for developing the Litani River. Since 1949, when he left Cornell, Donley has been serving as chief of the Hydrologic Studies Office of Region 1, U.S. Bureau of Reclamation, Boise, Idaho.

Colonel Charles F. Crone, M.E. '30, has recently returned from a European tour of duty which included command of the 63d Signal Operation. He was on the planning staff of Allied Forces Southern Europe in Naples, Italy, and was concerned with the organization, training, and equipment of Italian, Greek, and Turkish armed forces. He is now stationed at Fort Monmouth, New Jersey.

William P. Bamford, C.E. '33, is superintendent of Specialty Glass Division, Libbey-Owens-Ford Glass Co.

John W. Todd, Jr., M.E. '35, is assistant manager of alloy sales for US Steel Corp. He has been appointed to the town traffic commission and was elected a director of St. Clair Memorial Hospital in Pittsburgh, Pa.

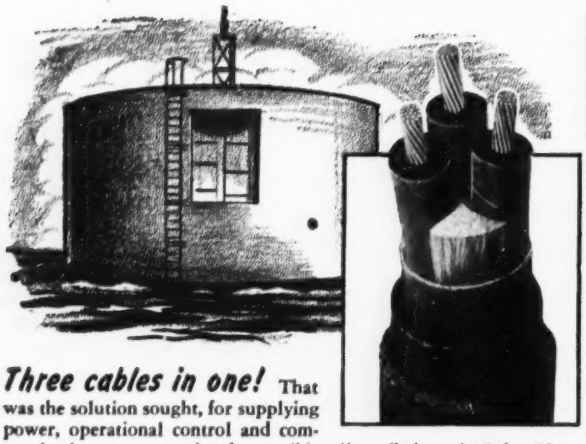
Frank Caplan, Jr., M.E. '42, and his wife (Shirley Rickard) '42, announce the birth of a son May 27. Caplan is a new process quality control supervisor at General Electric in Syracuse.

Joseph E. Nemeth, B.M.E. '47, 255-34 Seventy-fourth Avenue, Floral Park, is chief engineer with Vacuum-Electronic Engineering Co., New Hyde Park. His fourth child, Patricia Mary, was born August 1.

Robert J. Ratner, C.E. '48, and Susanne Malone Kauffman of Beverly Hills have recently announced their engagement. Ratner is a civil engineer with The Fluor Corp., Ltd. in governmental and industrial projects division.

David M. Smith, B.Chem.E. '51, married Laura E. Hallett, in Maplewood, N.J. They live at 6B Trelawn Terrace, Plainfield, N.J., and he works for Standard Oil Co. in Linden, N.J.

Gretchen A. Lawson, A.B. '52, and **Bruce A. Lentz, B.E.E. '51,** were married, August 28, in Mt. Lebanon, Pa. Bruce is in a training course with Kennecott Copper Co. in Salt Lake City. He is the son of Albert L. Lentz '19. Their address is Apt. 102, 708 East Third South, Salt Lake City, Utah.



Three cables in one! That was the solution sought, for supplying power, operational control and communication to a pumping house 4½ miles off shore in Lake Okeechobee, Florida.

As usual, Okonite engineers were consulted on the problem. Their studies showed that it was possible to combine a three-fold function in one cable. This was accomplished by the use of Okolite high-voltage insulation whose electrical characteristics permitted carrier current to be superimposed on the power conductors.

The result was a single Okonite-insulated cable—steel-armored for the 4½ underwater miles, with a non-metallic sheath for an additional 2½ miles underground—which supplies not only power and operation control, but a communication circuit as well.

● ● ●

Tough jobs are the true test of electrical cable . . . and installations on such jobs usually turn out to be Okonite.

OKONITE *insulated wires and cables*

8787

IN OUTSTANDING BUILDINGS EVERYWHERE . . .

JOHNSON AUTOMATIC TEMPERATURE CONTROL

Johnson, unique in American industry, is the *only* nationwide organization devoted exclusively to manufacturing, planning and installing automatic temperature and air conditioning control *systems*. This vast reservoir of experience is readily available to architects, engineers, contractors and owners through the large staff of Johnson engineers in the factory and 80 direct branch offices.

For 69 years, Johnson engineers have been called upon to solve every conceivable type of temperature, humidity and air conditioning control problem. Their interesting work takes them into industrial, business, educational, large residential, public and institutional buildings of all sizes and types. No wonder Johnson Control is first choice in outstanding buildings . . . everywhere! JOHNSON SERVICE COMPANY, Milwaukee 2, Wisconsin

JOHNSON *Automatic Temperature and Air Conditioning* CONTROL

MANUFACTURING • PLANNING • INSTALLING • SINCE 1885

What is in Store?

(*Continued from page* 11)

zations of various sizes and activities, as well as an assortment of other high-ranking titles.

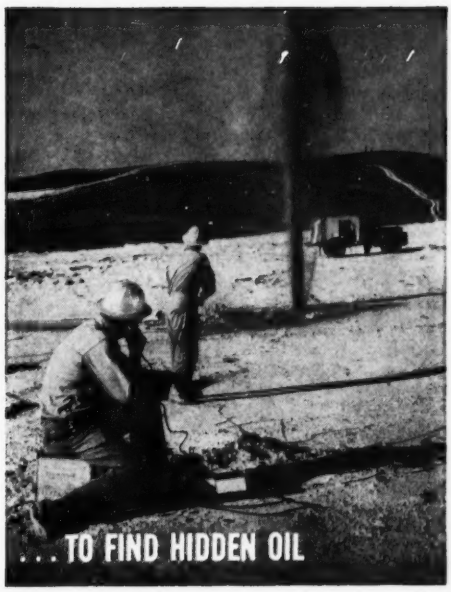
The other major category shows over one-third of the group in what might be termed "technical engineering"—design, research, development, consulting, etc. It is somewhat difficult to evaluate the actual level of performance in this category without looking fairly closely at the actual work carried out by each person, but it should be significant that 42 per cent of those in this category have distinctive job titles such as project engineer, chief engineer, consultant, etc., indicative of above-average accomplishment and responsibility. Again there is evidence of leadership among a substantial portion of this group.

Emphasis upon the management and technical engineering category above does not disparage the achievements of those in the less populated categories. Among those in engineering sales, for example, are several engaged in work calling for a high degree of engineering competence and judgment—and incidentally carrying some of the higher rewards in terms of salaries. Similarly, among the non-engineering group are a number in important posts.

Various speculations can be made concerning those in the class not covered by the returned questionnaire. For example, it may be that the less successful members are a higher proportion of this "no reply" group; however, it should be noted that the inquiry was not embarrassingly personal and in fact it provided an opportunity to indicate a desire for change of employment and to enlist the aid of the College employment service, factors which should have encouraged a reply from such persons. It may be thought, also, that a higher proportion of those in the "non-engineering" category are in the "no reply" group, but again there is no basis of fact available for this assumption. Other possibilities for "no reply," such as death, wrong address, and ordinary inertia complicate speculation as to the possible make-up of this group.

The significant fact is that the analysis of the class, as far as it is possible, indicates a remarkably high degree of what must be termed successful performance: a wide diversification of activity carrying out the tradition that Cornell Engineers "can do anything," and most important, a consistent trend toward *leadership*. Studies of other classes covering other periods show similar patterns, all substantiating the long record of professional eminence among Cornell Engineers.

In line with tradition, our engineers have indeed followed many individual paths, not a few ultimately traveling into the adjacent professions of architecture, law, medicine, and the ministry. One such became a Navy chaplain during World War II, and during a particularly critical operation on one of the South Pacific islands he was the only person available in the vicinity who could design and supervise construction of a desperately needed bridge. Obviously, once acquired, the "do anything" tradition is the proud symbol of the Cornell Engineer wherever his career may take him.

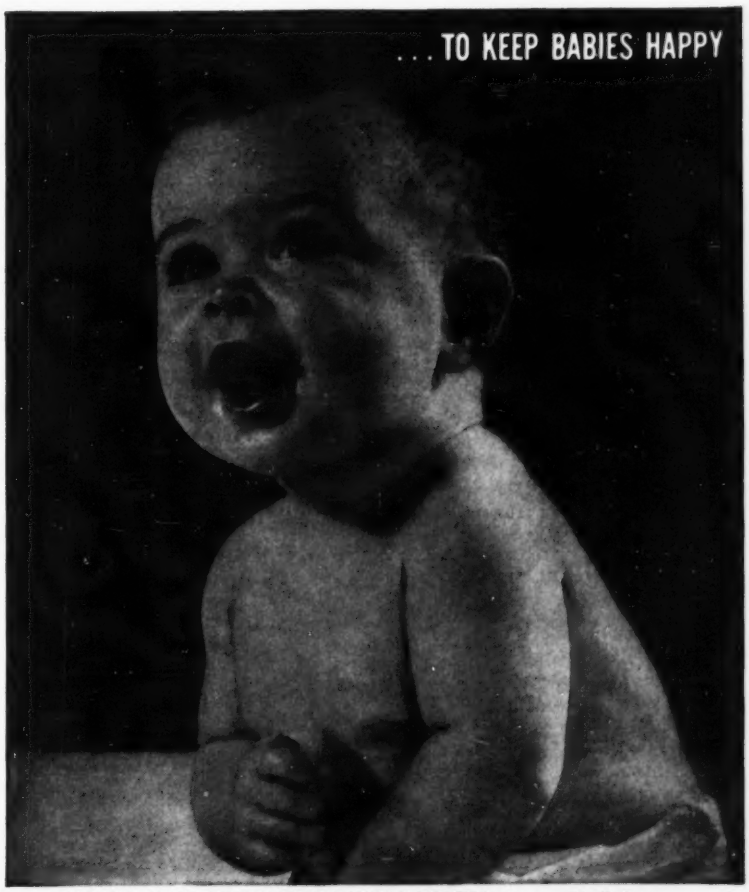


Hercules® explosives are used by geophysical crews to locate potential oil deposits. Hercules also makes cellulose and rosin derivatives that serve the petroleum industry in several ways—as in oil well drilling muds, corrosion inhibitors, and as additives in secondary recovery operations.

Livestock sprays made with Hercules Thanite® offer quick knockdown and high kill of houseflies, horn flies, stable flies. Thanite also fortifies household and aerosol formulations. Another Hercules toxicant—toxaphene—is widely used in agricultural insecticides.

HOW HERCULES HELPS...

Lotions for tender baby skins benefit from Hercules research in cellulose. Hercules cellulose gum—a water-soluble colloid—serves as an emollient, thickener, and suspending agent in lotions of many types. It's also found in toothpastes, face creams, and pharmaceuticals.

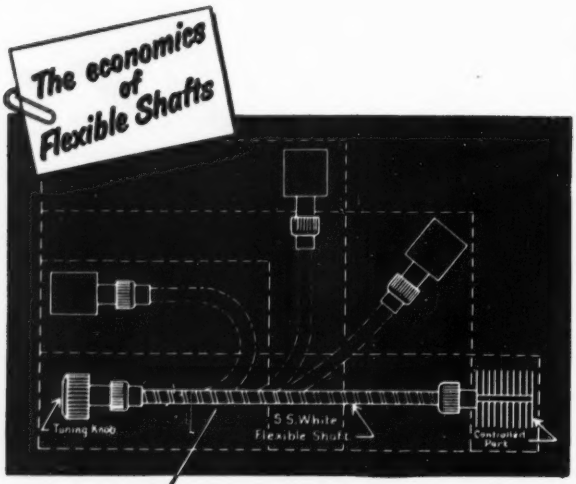


Hercules' business today helps almost everyone's business. It embraces the production of synthetic resins, cellulose products, chemical cotton, terpene chemicals, rosin and rosin derivatives, chlorinated products, and many other chemical processing materials—as well as explosives. Through close cooperative research with its customers, Hercules has helped improve the processing or performance of many industrial and consumer products.

HERCULES

HERCULES POWDER COMPANY Wilmington 99, Delaware
INCORPORATED
Sales Offices in Principal Cities

EC54-1



S.S.White Flexible Shafts ***make it easy to meet space and dimensional requirements***

The flexible construction of an S.S.White remote control flexible shaft allows controlled parts to be mounted where desired to satisfy limited space conditions and to meet specific equipment dimensions. These versatile "Metal Muscles"® can be snaked around turns and curves to provide a one-piece, sensitive control coupling between any two points. As a result, the designer has more leeway in developing a design that meets existing operating, assembly, and servicing requirements and can be produced at lower cost.

• • •

Many of the problems you'll face in industry will deal with the application of power drive and remote control with cost being an essential factor. That's why it will pay you to become familiar with S.S.White Flexible Shafts, because these "Metal Muscles"® offer important savings in transmitting power or control.

SEND FOR THIS FREE FLEXIBLE SHAFT BOOKLET

Bulletin 5008 contains basic flexible shaft facts and shows how to select and apply flexible shafts. Write for a copy.

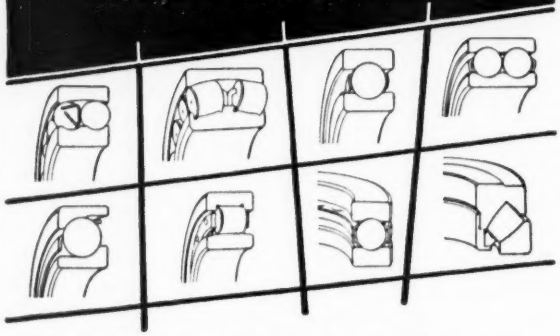
THE S.S.White INDUSTRIAL DIVISION
DENTAL MFG. CO. Dept. C, 10 East 40th St. NEW YORK 16, N. Y.

"Where Printing Gets Done"

NORTON PRINTING COMPANY

317 East State Street
ITHACA
Phone 4-1271

One for every place—
One place to get them all . . .



Out on the job . . . irrespective of your engineering role . . . you'll be coming to grips with the problem of eliminating wasteful friction.

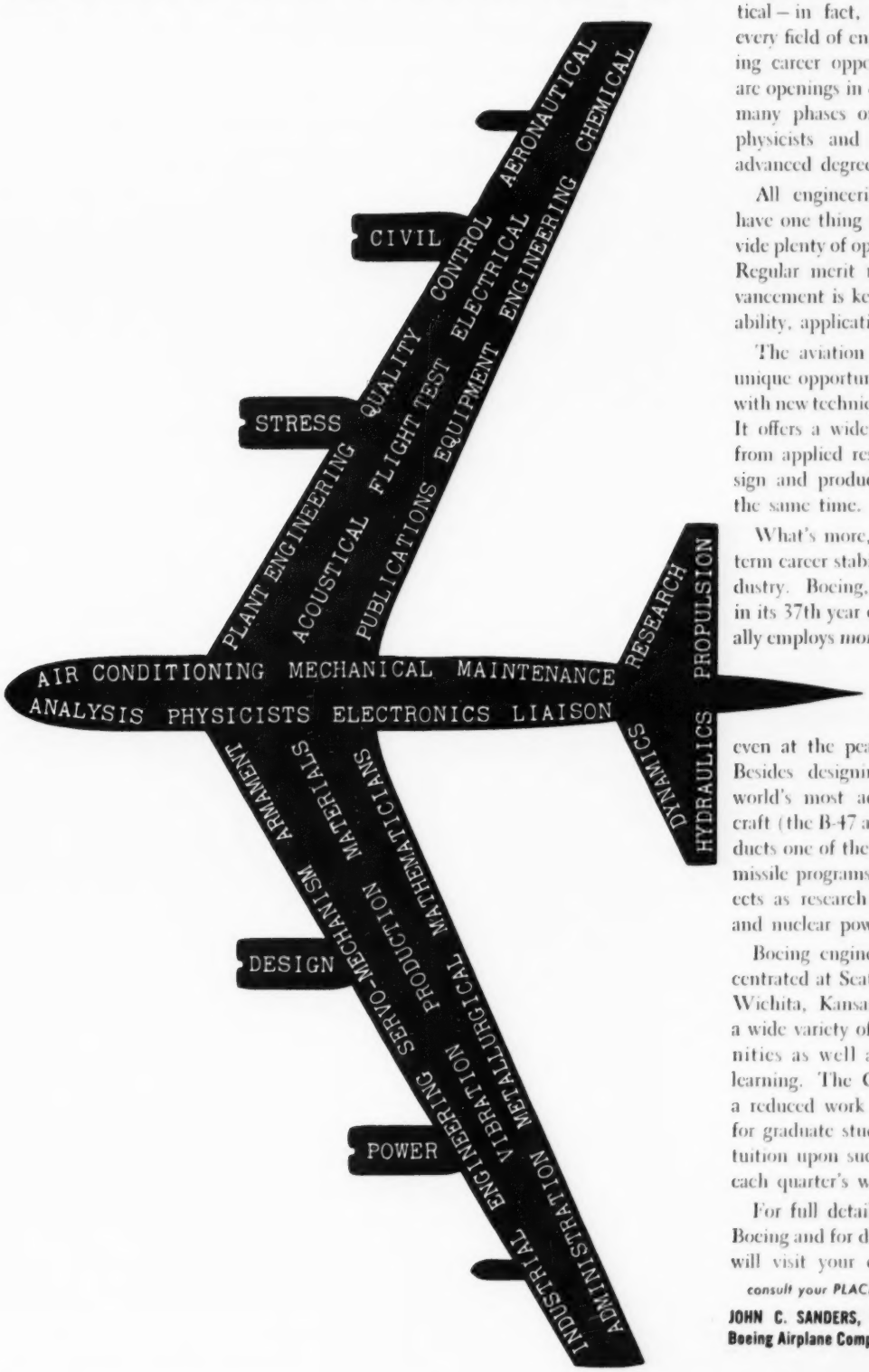
You can look to SKF for the practical solution to anti-friction bearing problems.

SKF makes all of these eight types of bearings which serve virtually every equipment need. Rely on SKF for *putting the right bearing in the right place.* 7417

SKF INDUSTRIES, INC., PHILADELPHIA 32, PA.
—manufacturers of SKF *and* HESS-BRIGHT *bearings.*

SKF
BALL AND ROLLER BEARINGS

Engineers of virtually EVERY type are needed on the Boeing team



Mechanical, electrical, civil, acronautical – in fact, graduates in virtually every field of engineering–find rewarding career opportunities here. There are openings in design, research, in the many phases of production, and for physicists and mathematicians with advanced degrees.

All engineering careers at Boeing have one thing in common: they provide plenty of opportunity to get ahead. Regular merit reviews are held. Advancement is keyed to your individual ability, application and initiative.

The aviation industry offers you a unique opportunity to gain experience with new techniques and new materials. It offers a wide range of application, from applied research, to product design and production, all going on at the same time.

What's more, you can expect long-term career stability in the aviation industry. Boeing, for instance, is now in its 37th year of operation, and actually employs *more* engineers today than even at the peak of World War II. Besides designing and building the world's most advanced multi-jet aircraft (the B-47 and B-52), Boeing conducts one of the nation's major guided missile programs, and such other projects as research on supersonic flight, and nuclear power for aircraft.

Boeing engineering activity is concentrated at Seattle, Washington, and Wichita, Kansas – communities with a wide variety of recreational opportunities as well as schools of higher learning. The Company will arrange a reduced work week to permit time for graduate study and will reimburse tuition upon successful completion of each quarter's work.

For full details on opportunities at Boeing and for dates when interviewers will visit your campus,

consult your PLACEMENT OFFICE, or write:

JOHN C. SANDERS, Staff Engineer – Personnel
Boeing Airplane Company, Seattle 14, Washington

BOEING

STRESS and STRAIN...

The designer bent across his board;
Wonderful things in his head were stored:
"How can I make this tough machine?
If this part here were only straight,
I'm sure the thing would work first rate.
But 'twould be easy to turn and bore;
It would never make a machinist sore.
I'll put in a right angle there.
Now he'll surely pull his hair.
Now I'll put the holes that hold the cap
Way down here where they're hard to tap.
This piece will work, I'll bet a buck,
But it can't be held in a jig or chuck.
It can't be drilled and it can't be ground,
In fact, the design is exceeding sound."
He looked again and cried "At last!"
"Success is mine! It can't be cast!"

* * *

The old fashioned girl used to stay home when she had nothing to wear.

* * *

"Of course you're not the first girl I ever kissed," said the senior Chem. E. as he shifted gears with his foot.

* * *

Veteran of the South Seas: "While in the Marshalls I saw the screwiest bird. It lays square eggs and talks."

Foreman: "Oh yeah! What does it say?"

Vet: "Ouch."

* * *

The other day a freshman said he thought a neckerchief was the president of a sorority.

* * *

Prof.: "Why didn't you answer when I called your name?"
C.E.: "I nodded my head."
Prof.: "You don't expect me to hear the rattle all the way up here, do you?"

Arts Student: I have a splinter in my finger.
Engineer: Been scratching your head?

* * *

"I shouldn't be offering you wine, should I. You are the head of the Temperance League, aren't you?" remarked the hostess to her male guest.

"Oh, no, I'm head of the Anti-Vice League."

"Well, I knew there was something I shouldn't offer you."

Co-ed: If you knew me better, you'd like me more.
E.P.: If I liked you more, I'd know you better.

* * *

Fraternity Brother: Did you know that we maintain seven homes for the feeble-minded?
Pledge: I thought you had more chapters than that.

* * *

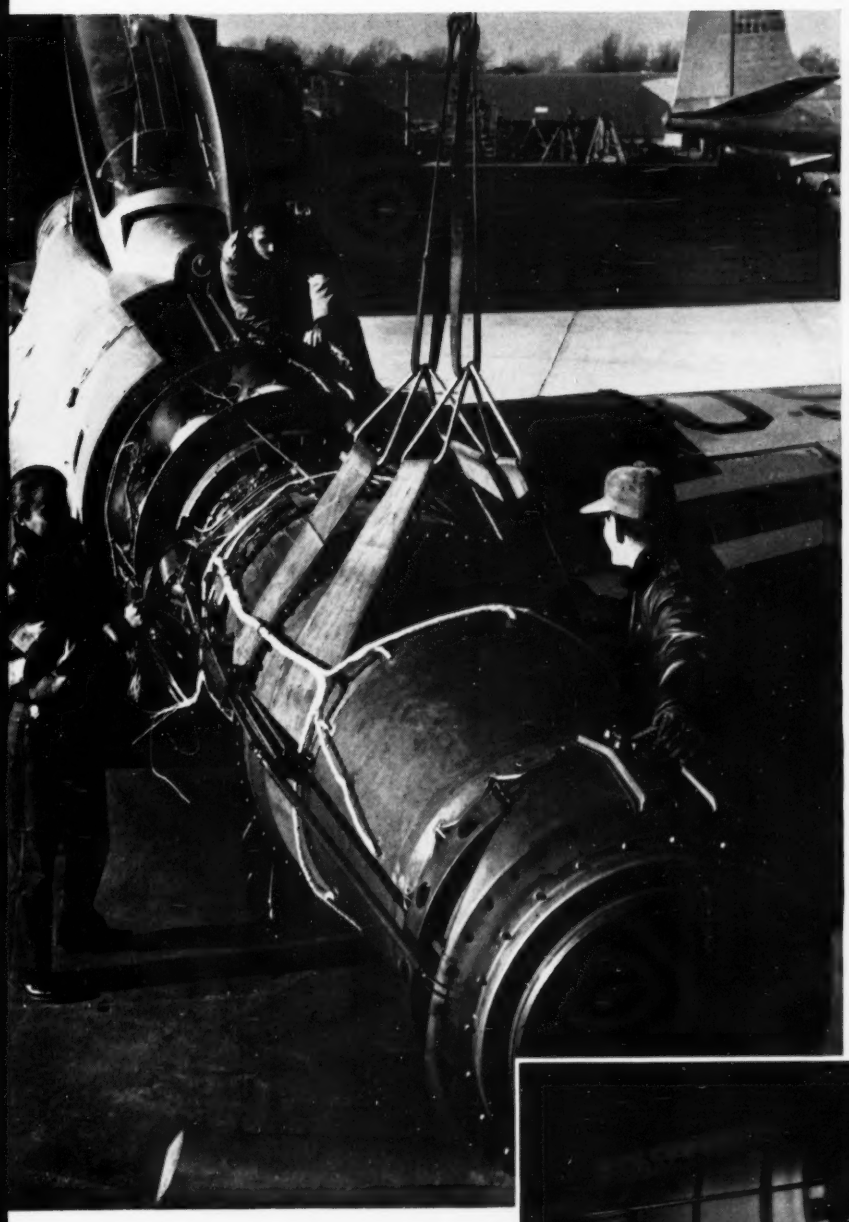
In golf, it's distance.
In a cigarette, it's taste.
In a Crosley, it's impossible.

..... YEP, THAT'S WHAT I SHOULD HAVE DONE.... YEAH, SHOULD HAVE TAKEN ARTS.... YEP, ...

PHOTOGRAPHY AT WORK No. 6 in a Kodak Series

Photography teams with research to slash industry's corrosion bill

Camera and Film work as research tools as International Nickel Company develops new alloys which prove tougher and defy corrosion.



Each year industry saves more and more millions on its corrosion bill by using Monel*, Inconel* and other corrosion-resisting alloys of the International Nickel Company.

To develop such alloys, "Inco" maintains extensive research—research that keeps photography on the job day-in and day-out.

This is because photography provides information which can be obtained and studied in no other way. Photomicrographs show metal structure. X-ray diffraction patterns reveal the arrangement of molecules. High-speed and time-lapse movies display the workings of corrosion.

Industries, large and small, find photography an important factor in their research—just as they know it improves manufacturing, cuts costs, and speeds many business operations.

"Today so many new applications of photography exist that graduates in the physical sciences and in engineering find them valuable tools in their new occupations. Other graduates—together with returning servicemen—have been led to find positions with the Eastman Kodak Company."

If you are interested, write to Business and Technical Personnel Dept., Eastman Kodak Company, Rochester 4, N. Y.

*Reg. trade marks of the International Nickel Co.

Eastman Kodak Company
Rochester 4, N. Y.

To stand up against intense heat and highly corrosive gases, vital jet engine parts such as rotor blades, afterburner, and insulation bindings are made of nickel alloys. Illustration shows a Pratt & Whitney Aircraft turbojet engine with afterburner.

Kodak

FROM CAMPUS — TO CAREER IS A BIG STEP

When the graduate leaves the college campus to begin his career he is taking an extremely important step. For he is leaving the area of directed-development in college and entering the area of self-development in industry.

Closing the gap between his campus experiences and the realities of earning a living is not easy. The complicated maze of modern industrial society has made this transition a tough task. While the craftsmen of former years grew up with the business, the college graduate of today steps into a strange organization at a relatively high level. He has had no opportunity to understand, through a long period, the methods and operations of the concern.

During his first few years, he is finding his place in the organization—learning its policies and objectives, and at the same time shaping his professional career. He needs all the assistance and guidance he can get.

Here at General Electric, hundreds of young men have found that intensive efforts are made to "bridge the gap" between college and industry—and to help young professional people realize their goals. Through extensive training programs, classroom study programs, leadership programs, and guidance in professional development, carefully selected young men are prepared for positions of responsibility and leadership in their individual fields.

Providing college graduates with the opportunity to know the Company and find the right job in it . . . giving them high-level, flexible orientation and training . . . offering continued opportunity for professional growth are most important tasks at General Electric. Nothing is more important—for our young professional people are our biggest asset.

If you are interested in building a career with General Electric, see your college placement director for the date of the next visit of the G-E representative on your campus. Meanwhile, for further information on opportunities with General Electric write to College Editor, Dept. 2-123, General Electric Company, Schenectady 5, New York.

GENERAL ELECTRIC